Rethinking Wildlife Management

Living With Wild Animals

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Thesis

submitted in fulfilment of the requirements for the degree of doctor

at Wageningen University

by the authority of the Rector Magnificus,

Prof. Dr A.P.J. Mol,

in the presence of the

Thesis Committee appointed by the Academic Board

to be defended in public

on Friday 21 September 2018

at 11 a.m. in the Aula.

Dedicated to Joost, Mariska, Eline, Charlotte, Julian

and in remembrance of my Mom and sister Annemieke.

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Chapter 1

Introduction

Introduction

1.1 Human-wildlife conflicts worldwide

"A black bear is wandering around oak brushes early evening, late summer 2011. (S)He is looking for high calorie food, because (s)he needs 10,000 to 12,000 calories a day to get fattened before hibernation in November/December. The bear wanders close by some small residential cabins that are mostly used for seasonal visits by second home-owners and their families. Then the bear encounters a cabin between the trees, smells some food flavors and wanders further to find the source. Close to the cabin (s)he sniffs. Coming closer the bear discovers an open window through which (s)he can enter the cabin. The bear enters, smells the food source and grabs it from the kitchen counter. (S)He tastes the food and after some time is interrupted by some noise nearby. Then, (s)he hears some human voices, but the noise has already scared the bear away. (S)He jumps through the open window, back onto the deck and into the garden. The human voices become loud, even shouting and screaming, and after a few seconds, when the bear is still moving away and climbing a tree, (s)he is shot in his/her rear end. More shots follow and (s)he is severely wounded. After some time up in the tree, another shot is fired by somebody else. (S)He falls down and is killed on the ground with a final shot."

This incident, which took place in a village in Colorado, U.S.A., is a reconstruction based on information provided by several respondents and on black bear ecology[1]. The example of a black bear breaking into a cabin, being wounded by the owner, and in the end being tranquilized and killed by a wildlife officer, is illustrative of the worldwide increase in conflicts between humans and wild animals (Knight, 2000b; White et al., 2009; WWF, 2006; Yeo & Neo, 2010). Such conflicts continue to increase in both frequency and severity as human populations expand, human pressures on ecosystems worldwide continue to increase through anthropogenic environmental change, and – as a result – wildlife habitats continue to shrink (Carter & Charles, 2011; Knight, 2000b; Madden, 2004a; White et al., 2009). Human-wildlife conflicts are inherently complex, often involving both undesirable interactions between humans and wild animals as well as disputes among (groups

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[1] In this thesis, the term black bear ecology refers to knowledge from the disciplines of ethology (the study of animal behavior), and behavioral ecology (a specialization within the disciplines of ethology and ecology with an emphasis on how animals behave in interaction with their environments).

of) humans about wild animals (Douglas & Veríssimo, 2013; Knight, 2000b; Urbanik, 2012). How these conflicts are managed is determined by a number of factors, including the *spatial interactions* between humans and wild animals, the *data* used to justify a particular wildlife management strategy[2], and the use of *categories* for the involved humans, wild animals and their interactions. Examples demonstrating the influence of these three key factors on the management of human-wildlife conflicts have been chosen from around the world. They illustrate that these factors are not self-evident but are – often – highly contested.

In areas with high or rising human population densities, wildlife and humans increasingly compete for *space* to call 'home' (Madden, 2004b; White et al., 2009). For instance, in East London in 2010, UK, nine-month-old twins were injured by a fox while they were asleep (Cassidy & Mills, 2012). The fox had been able to get into their bedroom through an open window. This incident resulted in a public debate about the 'right' space for foxes in and around London. While fox experts declared this occurrence to be rare fox behavior and identified the incident as an act of an individual, probably sick, juvenile, or habituated fox, most media coverage initiated debates about 'urban', 'rural', and 'wild' animals and where, that is, in what 'space', the respectively categorized species should belong (Cassidy & Mills, 2012). Questioning the 'right' space for humans versus wild animals is the essence of a human-bear conflict in the sparsely – human – populated area of rural-upland Japan (Knight, 2000a). Bears are perceived to be a threat to farms, timber plantations and people. Traditionally, the presence of bears has been a symbol of rural 'backwardness' and has encouraged local residents to leave the area. Actual conflicts between humans and bears, as well as the existing perceptions of bears, have resulted in questions, based mainly on safety concerns, concerning whether humans should live in these areas at all. Currently, however, bears are seen to have been 'forced' by human society to live up in these mountain areas because other potential bear-spaces have become occupied by humans (Knight, 2000a). These two opposing notions have resulted in tension regarding which management strategy to use: bear culling or bear conservation. The complexity of human-wildlife spatial interactions and their management is further illustrated by a proposed change in the management of the

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[2] A wildlife management strategy consists of a particular (set of) management activity(ies) with a specific purpose. In this thesis, a wildlife management strategy consists of a particular (set of) activity(ies) that are designed to disentangle human-wildlife conflicts and/or to seek cohabitation between humans and wild animals. Examples are varied and range from lethal control and translocation of the conflict animal to behavior modifications (both human and wild animal) intended to prevent or reduce future conflicts between humans and wild animals. Note that 'don't intervene' is also a management strategy.

elephant population in Amboseli National Park, Kenya, in the 1990s (Thompson, 2002). A change in management was required due to the presumed problem of too many elephants that were inhabiting the park. The key dispute in deciding which management approach to employ involved conflicting views about the use of space. This so-called human-elephant-biodiversity dispute originated as the result of an acute increase in an individual elephant population inside the park boundaries alongside a decline in woodland and biodiversity in the Amboseli ecosystem, both inside and outside the park boundaries. In the 1970s, the management of elephants involved protecting them inside the park due to a decline in their numbers as a result of poaching and the increase of local settlements surrounding the park. By the 1980s the elephant density in the park had increased approximately fivefold. By the late 1980s the results of a ten-year woodland experiment suggested that the acute increase in elephant numbers had resulted in a severe woodland and biodiversity loss in the Amboseli ecosystem. This generated debates about which management strategy to employ to conserve elephants, woodland, and biodiversity, while at the same time controlling conflicts between elephants and the surrounding community, which was principally made up of farmers. These management strategies differed in their use of space and their effect on existing boundaries. One proposed management strategy was to cull the elephant population inside the park up to an elephant density that would allow restoration of the woodland and biodiversity. This would, at the same time, prevent human-elephant conflicts with residents surrounding the park as the elephants would remain within the park boundaries. Another proposed management strategy was to let the elephants move beyond the park boundaries and control possible ensuing human-elephant conflict by providing residents with limited hunting opportunities. The reasoning behind the latter strategy was that the movement of elephants through space would allow the typical Amboseli ecosystem to regenerate and be conserved. Additionally, the local community would benefit economically through the provision of limited hunting permits. A third management strategy, proposed by a group of elephant behavior researchers, contested these two management strategies and suggested an enlargement of the park to conserve the elephant population. Their reasoning was based on the intention to protect the "*intrinsic rights of complex social animals*" (Thompson, 2002, p.174) and maintain the production of scientific knowledge. The complex use of space by humans, elephants and in the interest of maintaining biodiversity in and around Amboseli National Park rendered it difficult to find a management strategy that would achieve the best spatial use for each purpose. All the above examples illustrate that spatial issues in wildlife management practices are inherently complex, especially with regard to managing human-wildlife conflicts.

The employment of *data* is also important in managing human-wildlife issues (Bear, 2006; Enticott, 2001; Latour, 2004b; Roth & Bowen, 1999). For instance, in the Amboseli case discussed above, the availability of data turned out to be a major factor in the dispute between the three competing management strategies (culling elephants in the park, letting them migrate outside the park or protecting the elephants by enlarging the park) (Thompson, 2002). The data used to determine which would be the best management strategy to settle the human-elephant-biodiversity dispute came from three different sources. One was the ten-year woodland experiment discussed above. Based on the results of this experiment, it was suggested that elephants were responsible for approximately 85 percent of the loss of woodland. Another data source came from the research conducted by a conservation scientist who, in the same time period, demonstrated a causal relationship between elephant density and biodiversity: too-low elephant density resulted in a loss of biodiversity, and too-high elephant density also resulted in a loss of biodiversity. Based on these data, it could be concluded that a medium elephant density would result in the highest biodiversity in the Amboseli ecosystem. These two data sources were used to support the strategy of culling of elephants (inside and outside the park) and/or allowing their migration across the borders of the park. However, the group of scientists studying elephant behavior referred to a third important data source that had not been addressed, specifically, the production of scientific knowledge about the Amboseli elephants over time. In their view, neither culling nor permitting migration across the park boundaries provided a satisfactory solution. Instead, they proposed that the park should be enlarged to maintain the elephant population and the associated – very valuable – knowledge production about elephant conservation (Thompson, 2002). This example demonstrates the importance of the kind of data that is used to inform management decisions; each of the three proposed management strategies could be justified using specific data.

The example of the Amboseli elephant suggests that the use of data cannot be understood without consideration of the context. The (possible) consequences of data being treated as unquestioned facts in the determination of management strategies is made explicit in the case of the outbreak of Foot and Mouth Disease (FMD) in Cumbria, UK, in 2001 (Law & Mol, 2008). To halt the spread of FMD, policy called for the implementation of a massive slaughter of Cumbrian sheep. A variety of cull-strategies were implemented from range-specific pre-emptive culls to the slaughtering of all animals on contiguous premises (usually farms). However, because of the far-reaching consequences for the sheep and the farmers, the data upon which these cull-strategies were based were subjected to frequent questioning. It turned out that each instance of culling was based on different calculations of the

number of sheep that ran a considerable risk of being infected. These calculations were based on a variety of statistical concepts and models, each involving specific assumptions. The models were run using a variety of data from previous outbreaks, including from areas other than the Cumbrian district, occasionally even bundled with data from cattle and pigs, and including both infected and non-infected sheep. As such, a variety of data were used to propose and justify a variety of cull-strategies, with severe consequences for sheep and farmers in FMD management. Like the above example of the Amboseli elephants, this example illustrates that data are essential in justifying management strategies. However, data do not automatically translate into clear-cut management strategies or the avoidance of conflict.

Next to space and data, *categories* such as 'problematic', 'intrusive', 'habituated', and 'corrupt' are commonly used in wildlife management. For instance, when a black bear is characterized as 'problematic', as in the case of the black bear in the example at the beginning of this chapter, this generally implies that the particular animal will be killed (Bekoff & Pierce, 2017). Typically, the type of behavior displayed by a 'problematic' wild animal is behavior humans find undesirable. Consequently, it is argued that management is needed. To further illustrate the use of categories, including their multiple interpretations and consequences, I examine the example of the recovery of the wolf in Europe. The number and distribution of wolves have been increasing in recent decades. Although the return of the wolf to many areas in Europe (Boitani et al., 2015) might be viewed as a conservation success, it has also resulted in controversies. One of these controversies surrounds their protected status in many European countries versus the damage they may inflict upon livestock. According to European legislation, wolf populations are protected by the Habitat Directive through the establishment of sites for wolf recovery (Annex II) or strict protection (Annex IV) (Council of the European Communities, 1992). Strict protection means that any destruction or damage to a wolf population is prohibited. However, derogation of strict wolf protection is still possible. Three options in particular stand out: the first balances the weight of public interests versus those of the wolves, as described by the conservation aims of the Habitat Directive. The second refers to allowing for the management of a particular, 'limited', number of wolves, as set out in a wolf management plan that specifies the management strategies that may be implemented. Implementation often entails killing the respective wolves (Environment Directorate-General, 2007). The third is granted when the damage to human (property) is regarded as serious, and not merely a nuisance (Environment Directorate-General, 2007). Based on these derogation possibilities, some wolves might be categorized as 'problematic', while others might be regarded as a

'nuisance' or 'unproblematic' and remain categorized as protected. Categorizing a wolf as 'problematic' has, however, serious consequences for that particular wolf: if no alternative is available, it will most likely be killed. However, what is meant by 'problematic' and 'mere nuisance' in actuality remains unclear. Similarly, neither the thresholds for the number of wolves that determine whether or not wolves need to be managed, nor what is to be regarded as 'serious damage to property' are (well) defined, although they all seem to be essential in determining management strategies, and they have severe consequences for those involved (both human and animal). While categories might be helpful in human-wildlife management, at the same time, especially because they are frequently contested, they can increase the difficultly of settling conflicts. Defining what is regarded as 'problematic' has become more topical since wolves have been sighted near large cities, such as Rome, Italy (Edwards, 2017; Katz, 2017; The Local, 2016). This has (re-)opened debates about how the wolf's behavior is perceived and whether or not the mere presence of wolves near a city might be regarded as 'problematic': wolf experts argue that wolves are typically shy of humans (Linnell et al., 2002), while in some sections of society, the image of the wolf as aggressive dominates, and the presence of wolves is cause for anxiety. These (new) sightings of wolves may reawaken questions concerning the 'right' place for wolves and the data that should be used to manage their occurrence and could subsequently lead to the reconsideration of (prevalent) wolf management strategies.

The wild animals that roam in places where they – arguably – do not belong, such as wolves near human settlements, are said to be 'out of place' and, consequently, require management (Douglas, 1966). I use the term 'invasive' to capture this 'out-of-placeness' of animals. In doing so, I deviate slightly from the more common meaning of this term in ecology, whereby the terms invasive, or alien invasive, are used to refer to non-native species (Richardson et al., 2000). The case of the city of Berlin, which has been colonized by approximately 3,000 wild boars, exemplifies the worldwide struggle over the implementation of strategies concerning the management of human-wildlife interactions in conflict situations involving invasive wild animals. Both separating humans and wild boars and eradicating the wild boars from the city have become nearly impossible. As a result, the government has stated that wild boars have become de facto part of Berlin's scenery, and humans and wild boars sharing the same space has become a key focus in wild boar management (Arms, 2011; Berlin Senatsverwaltung für Stadtentwicklung und Umwelt, 2015; Kynast, 2017; NABU, n.d.; Nicholson, 2012). Management focusses on prevention of human-wild boar conflicts, to be accomplished, for instance, by educating inhabitants about the consequences of feeding wild boars and how to

protect human property from rooting. Although conflicts between wild boars and humans in Berlin are inevitable, since they compete for the same space and resources, the Berlin government allows hunting wild boars only in problematic situations, for example, when human safety is at stake. Ultimately, wildlife management worldwide faces an inevitable increase in human-wild animal interactions, and a concomitant increase in human-wildlife conflicts, such as in Berlin, can be expected. It has therefore become a management objective to find ways in which humans and wild animals can co-exist or cohabitate (Hinchliffe et al., 2005; Knight, 2000b; Lorimer, 2006a). However, the answer to the question of how to implement 'living together' remains unclear. For instance, does seeking cohabitation call for a (radical) new approach to management involving the accumulation of more knowledge about human and/or animal behavior, or does it simply require another way of using – already available, but obscure – knowledge?

In this chapter, I have demonstrated thus far that managing human-wildlife conflicts commonly involves the negotiation of spaces, data, and categories. However, I have also shown that these three factors are often highly contested and not self-evident. As a result, problems may arise in the implementation of wildlife management strategies designed to disentangle human-wildlife conflicts, especially those seeking human-wildlife coexistence. Due to the worldwide increase in conflicts between humans and wild animals, and the difficulties faced by wildlife management practices when attempting to anticipate and control human-wildlife conflict situations, the question of 'how to live with wildlife' becomes an urgent one. It necessitates a detailed investigation of those wildlife management practices that seek human-wildlife coexistence (European Commission, 2015; Madden, 2004b). Scholars have proposed the concept of cohabitation to describe the situation in which humans and wild animals interact and inhabit the same area. Understanding such interactions can provide insight into managing human-wildlife interactions (Barua, 2014a, 2014c; Hinchliffe, 2007; Ingold, 2005; Lorimer, 2006a, 2006b; Lorimer, 2010a; Madden, 2004b). This thesis contributes to the above discussion by questioning whether current wildlife management practices and management strategies can lead to cohabitation between humans and wild animals. Put succinctly, this means 'living with' as opposed to 'living alongside'.

This thesis suggests that cohabitation strategies require another, relational, focus on the use of spaces, data and categories than a rather static use of these factors, which is currently prevalent in wildlife management practices. Specifically, it will be argued that wildlife management practices need to incorporate more insight into the relationship between humans and wild animals rather than either more knowledge about the wild animals themselves or about the humans involved. That

is, it is the interactions between wild animals and humans and how these interactions can be managed that should be better understood. Because these interactions are dynamic in nature, a (more) dynamic approach to wildlife management and the concomitantly employed spaces, data and categories is required. It is necessary to ask in how far current wildlife management practices already incorporate such a dynamic approach in their aim to resolve human-wildlife conflicts and achieve cohabitation ("Creating coexistence", 2004; Knight, 2000b). As I will explain in more detail in the next section, I intend to explore the processes through which the spaces, data and categories in current wildlife management practices are defined, contested and negotiated. I will also explore cohabitation and the associated cohabitation strategies, including the corresponding use of spaces, data and categories – both as a critique of and as an alternative to the currently prevalent dichotomous (human versus wild animal) and anthropocentric approach to wildlife management.

1.2 Conceptual framework

The research into wildlife management practices and the use of wildlife management strategies in human-wildlife conflict situations discussed in this thesis makes use of three sensitizing concepts as its point of departure: space, data, and categories. These three underlying concepts are formulated as they were understood at the beginning of this research in the section below. They are further discussed in the following chapters. Cohabitation is introduced as a fourth concept in 1.2.2, and it will be further theoretically developed in the course of this research. In the synthesis, I will reflect on the concept of cohabitation in wildlife management practices and the use of space, data and categories in cohabitation strategies.

1.2.1 Space, data and categories

Space

Space as a concept can be understood in multiple ways. First, wildlife management practices can be understood as a space in which a variety of spatial interactions between humans and animals occur. However, space can also refer to specific wildlife management practices involving particular wild animal species in particular locations in which spatial interactions occur between humans and the particular wild animal species (Urbanik, 2012). Yet another conceptualization of space refers to spaces for nature versus spaces for humans (Hinchliffe, 2007). This latter conceptualization implies a neat division, without overlap, between spaces for nature and spaces for humans. Thinking in terms of spaces for nature versus humans also implies that an 'inside' and an 'outside' can be created with a well-defined boundary in between. Examples of such clearly delineated spaces include nature reserves,

national parks, villages or homes. However, humans and wild animals are not always neatly arranged in the landscape where they dwell. They move around in time and space, and, consequently, they cannot always be managed in an 'orderly' manner. This becomes particularly clear in human-wildlife conflict situations in which pre-determined (spatial) boundaries are under dispute. In fact, the spatiality of human, wildlife and landscape (including topography and climate) has an impact on the interpretation of the corresponding human-wildlife interactions as problematic, dangerous or conflicting. These spatial interactions determine which, if any, management actions are considered appropriate (Hinchliffe et al., 2005). As such, understanding situations in which humans, wildlife and landscape come together requires a conception of space that is not closed or static, whereby the spaces of human-wild animal interactions do not pre-exist and cannot be pointed out on a map or depicted by other typologies as nature versus society. I therefore employ a conception of space that is relational, involving spaces that are shaped by human-wildlife-landscape interactions. As such, this conception of space means that also the material, physical, space has to be seen as relational. The material spaces that are referred to in this thesis are both human-modified and naturally occurring spaces that can be traversed by humans and wild animals and constitutes what we sometimes call 'territories' with particular (e.g., geographical or political) borders or 'landscapes' (Hinchliffe, 2007; Massey, 2006; Merriman et al., 2012; Urbanik, 2012). Time is explicitly included in this conception of space, because changes over time, such as seasonal shifts and climatic changes, might result in changes (over time) in human-wild animal-landscape interactions and in changes in the material world, such as land degradations or forest fires. Such spaces can be understood as – temporally, materially – fixed, having temporal stasis but remaining open to change as a result of changes in the spatial relations among humans, wild animals and landscape (Hinchliffe, 2007; Massey, 2006). Understanding space in this broader way involves a sense of space as dynamic and constantly in-the-making. In the practice of wildlife management, this means that space is to be understood through the spatiality of human-wild animal-landscape processes, for example, the spatiality of wild animal movements as a response to seasonal shifts in food supply in the landscape or the encroachment of humans building in these food-supplying habitats. Changes in spatial relations and spatial processes occur when boundaries are transgressed by either human or wild animal. This resultingly is a conceptualization of space in which spaces are modified according to such factors as humans encroaching on previously wild areas, wild animals invading human populated areas, and shifting weather conditions. It provides a useful concept when trying to understand the creation, disentanglement, and anticipation of human-wildlife conflict situations (Hiedanpää et al., 2012; Johnston, 2008).

Data

Defining the extent of a problem in human-wildlife conflict situations, whether regarding number, severity or scale, commonly begins with measuring and quantifying. The data that are collected, especially numbers and their concomitant numerical calculations, contribute to an attempt to objectively define problems and solutions and make decisions that are well-organized and accountable (Asdal, 2008; Enticott, 2001; Martin & Lynch, 2009; Roth & Bowen, 1999; Stone, 2002). Such data are often presented in the form of graphs, tables, or percentages, and they are frequently used to formulate policy and justify which management strategies should be employed in human-wildlife conflict situations. The presentation of these numbers often goes hand-in-hand with cues such as 'decline' or 'increase', which are intended to assist understanding and suggest the implementation of strategies in a policy and management context (Enticott, 2001; Stone, 2002). For instance, in policy debates, different types of numbers are articulated, or strategically selected and presented. But, only those numbers that claim 'scientific' status are accepted. However, these collected, processed, and presented data, such as, the number of humans or animals present in a certain area, the number of animals that form a population, the characteristics of the landscape, or animal reproduction rates, are often treated as universally valid and unquestionable facts (Asdal, 2008; Enticott, 2001; Hinchliffe, 2007; Porter, 1995). Treating data as universal and as self-evident in the determination of wildlife management strategies is problematic in several ways. First, the data available to be employed to formulate and justify management strategies are often inadequate. Such data might, for example, be outdated and incomplete in view of the particular human-wildlife conflict. Or, the landscape may have changed considerably, or the data may have been collected with a different purpose in mind. Second, it is common practice to use the same data to produce a wide variety of management plans and policy recommendations by using them in diverse models independent of how well such data fit (Bowker, 2000). Third, the quality of data collected in the field is dependent on the knowledge of the collector and, therefore, may include many uncertainties. It also reflects the collector's engagement with and personal interpretations of the respective wild animal or landscape features under investigation, as well as his or her particular field skills (Bear, 2006; Hinchliffe, 2007; Hinchliffe et al., 2005; Lorimer, 2008; Roth & Bowen, 1999). The numbers that are scribbled on a paper and later entered in a computer and further processed in a variety of calculations, should, therefore, not be taken at face value. The resulting data include several transformations as well as a variety of interpretations occurring at each step in the process of collection, coding, processing, calculating, modelling, presenting and eventually the use of that data by a variety of people, for example, to justify management strategies (Bear, 2006;

Latour, 1999; Roth & Bowen, 1999). A fourth difficulty arises from treating data as universal when considering and managing specific human-wildlife conflict situations: in the course of processing the collected data, the individual wild animal and the locality of the landscape in which it dwells has disappeared (Bear, 2006; Enticott, 2001; Hinchliffe et al., 2005; Roth & Bowen, 1999). An in-depth understanding of the everyday interactions of humans with wild animals and the conflicts that might arise could provide insight that would assist wildlife management in anticipating and preventing these conflicts. For that purpose, another kind of data is required, as well as an approach to data that is situated in the local context where the respective human-wild animal interactions take place. It also requires an understanding of data that incorporates some of the less obvious aspects of data and data collection that are fundamental in the determination and justification of management strategies. These include data about the (individual) wild animals, (individual) humans, (individual) interactions between them, and about the landscape where these interactions occur. This conception of data also contributes to bringing the (individual) wild animal back into the conversation concerning the management of human-wildlife conflicts (both as an academic and a management concern).

Categories

Categories, such as 'invasive', 'problematic', and 'habituated', are commonly used to organize wildlife management decisions and actions and, subsequently, to make the complexity of the world more manageable (Bowker & Star, 2000; Jones, 2009). They might be used in a particular local area within a local wildlife management plan. On the other hand, categories such as species categories are commonly used across the world (e.g. IUCN, n.d.). Categories such as animal species are not problematic in themselves. However, there are three related problems associated with the use of categories. First, the process of categorization is problematic because it involves bootstrapping difficulties (Bowker, 2000). Since categories are not simply derived directly from nature, but are man-made, certain criteria lay at their foundation (Dean, 1979). This means that to be able to define categories, humans must already have preconceived ideas about what needs to be classified (Bowker, 2000; Turnhout, 2009). At the same time, to be able to classify something requires the existence of categories or a classification system (Turnhout & Boonman-Berson, 2011). For instance, with regard to the taxonomy of animal species, animals are classified according to a variety of species-specific characteristics, such as reproductive success, behavior, and physical characteristics. Simultaneously, classifying animals based on their pre-defined characteristics flows from the idea of a classification system that is founded on the principle that each identified being has

its own 'proper place' relative to all other beings, and they can be neatly identified, delimited, and positioned in the relevant conceptual category. This brings us to a second, related problem concerning the understanding of boundaries surrounding categories as fixed and closed. The result of using such classification systems and categories for animals is to fix them in a series of abstract boxes, or 'animal spaces'. However, these neat and proper delimited spaces are in stark contrast to the messy everyday life and practices of these animals (Philo & Wilbert, 2000). In practice, these categories are often dynamic and open to multiple interpretations, without clear-cut, self-evident boundaries or definitions (Bowker, 2000; Jones, 2009; Turnhout & Boonman-Berson, 2011; Turnhout, 2009; Waterton, 2002). For example, in the practice of wildlife management, it is often unclear which characteristics or thresholds have been used to define whether or not an animal is categorized as 'invasive', 'problematic', or 'habituated'[3]. However, species categorized as problematic will be managed in a particular way; that is to say, they are often killed. Understanding the behavior of these 'problematic' animals, as well as other humans and animals in conflict situations, in a spatial and context-specific way could provide the information necessary to choose a management strategy that is appropriate to the situation. The conception and use of categories as closed, bounded and empty containers to be filled, or not, carries with it a third problem, specifically, that of obscuring and ignoring the diversity of the world (Jones, 2009). This revolves around the 'taken-for-grantedness' or 'naturalization' of categories (Bowker & Star, 2000; Foucault, 1970; Turnhout, 2016). When categories are taken for granted, or if they have become naturalized, the contingent, messy, complex part of the world they represent and replace has been, or can be, forgotten (Bowker & Star, 2000). Consequently, what has not been included in such categories, for example, field data that were not recorded because they did not seem to 'fit' the category, will most likely be forgotten and therefore will not be taken into account in making management decisions. In other words, categories also exclude, ignore or silence aspects of nature and the environment that do not fit (Turnhout, 2016). The use and heavy reliance on categories in wildlife management practices has resulted in an *"indifference to difference"* (Hinchliffe, 2007, p. 155) in managing wild animals and has created more 'sameness' in managing them (Lulka, 2004). For

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[3] In arguing for examining the ways in which a category is shaped, the use of the category 'wild' or 'wildlife' in this thesis is also brought into question. In that regard, I follow the definition given by Urbanik (2012, p. 139): a 'wild' animal in this thesis is referred to as an individual member of, or group of, a particular species that has not been actively controlled by humans. 'Wild' animals may live in very close proximity to humans; however, they are not under human control. In this thesis, therefore, it should be kept in mind that human-wildlife interactions are not simply about the wild animals out there, 'in the wild', but also about wild animals in urban, suburban, and rural areas.

instance, wildlife management often seeks to maintain and manage an 'ideal' population of wild animals in a particular area, based on genetics and containment, rather than make use of the dynamic, context-specific, diverse human-animal interactions. However, more insight rather than less into the complexity of the differences among humans, among animals and among humans and animals is necessary in managing human-wildlife conflicts. This requires a rethinking of a variety of 'taken-for-granted' categories in wildlife management and shifts attention to the practices of 'doing' – or constructing – these categorizations, which might subsequently reveal the key processes of human-wildlife interactions that are at the basis of many of these categories (Lorimer, 2006b; Urbanik, 2012). Based on the problems I have identified with categories in wildlife management, and to better understand the current dilemmas that wildlife management practices face as a result of the increase in human-wildlife conflicts, I introduce a conceptualization of categories that is dynamic and includes humans, wild animals, and their interactions in the surrounding landscape, as well as the processes through which the boundaries between the variety of used categories are constructed (Jones, 2009). Such categories foreground the specific human-wild animal relations that exist in a particular area or that are part of the particular conflict situation. For instance, based on Lulka (2004), such a conceptualization shifts the focus from managing 'the Yellowstone' bison herd to managing the diverse human-bison relations in the greater Yellowstone ecosystem.

Before moving to cohabitation between humans and wild animals in the next section, I will clarify my focus on wildlife management as a practice in this research. Typically, wildlife management practices have anticipated and overcome human-wildlife conflict situations through the implementation of wildlife management strategies based on rather rigid criteria drawn from formalized conceptions of space, data and categories for deciding which species will be targeted and how they will be dealt with (Wolch & Emel, 1998). However, I have demonstrated that these management strategies are associated with a vast array of conflicts over boundaries and interpretations. Ultimately, the spaces employed, data, categories and corresponding boundaries are the outcome of context-specific interactions and are negotiated in practice. Furthermore, the dominant focus in wildlife management, and the corresponding design of (formal[4]) management strategies, has been concerned with excluding wild animals from human environments (Wolch, 1998), and on biological structures, and phenomena. This type of management reveals a

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[4] Formal management strategies are management strategies that are formulated in policy regulation as well as wildlife management plans. These may differ from other, informal management strategies implemented in the field.

dichotomous (human versus wild animal) and anthropocentric approach to wildlife management. Such an approach does not accord attention to all of the humans, wild animals, and interactions involved in shaping the phenomena that these practices will influence. For instance, management strategies frequently exclude or are often not oriented towards humans (Baruch-Mordo et al., 2009, 2011; Yeo & Neo, 2010). Additionally, wild animals are not generally regarded as co-shaping the design of management strategies, although research has demonstrated that they influence them. Humans and wild animals share the same space, and their interactions matter, for example, with regard to how particular areas are demarcated. If these wild animals and their interactions with humans were taken into consideration, they might have an impact on the spaces, data and categories employed in wildlife management. Therefore, to properly understand and analyze spaces, data, categories and the related human-wild animal interactions, wildlife management needs to be considered as a practice. Ultimately, human-wildlife conflicts and the concomitant wildlife management practices that address these conflicts are inherently dynamic practices in which the relationships and interactions among humans, wild animals, and the landscape where they roam, are key features. These relationships and interactions might change as a result of changes in terms of actions, sayings, understandings, landscape characteristics, and learning (Arts et al., 2013; Behagel, 2012; Carter & Charles, 2011; Johnston, 2008). Consequently, these interactions involve both doing and knowing (Eden & Bear, 2011). As such, in this research, knowledge is directly linked with practice and, consequently, wildlife management practice in this research is conceived of as a practice that involves ongoing interactions among humans, wild animals and the landscape (Eden & Bear, 2011; Latour, 2007). Due to these ongoing interactions, these practices are viewed as open-ended, dynamic, and fluid (Barad, 2003; Haraway, 2008; Hinchliffe & Whatmore, 2006; Lorimer, 2008b; Whatmore & Thorne, 1998). Next, I will consider my understanding of cohabitation in wildlife management.

1.2.2 Cohabitation and wildlife management

Cohabitation, co-existence, living together, multispecies communities, and living with, are all terms used to describe ways in which humans and animals engage with each other and inhabit the same area. They address the question of how this 'sharing' between humans and wild animals can be understood and addressed in wildlife management practices (Barua, 2014a, 2014c; Bear & Eden, 2008; Haraway, 2010; Hinchliffe et al., 2005; Hinchliffe & Whatmore, 2006; Lorimer, 2006a; Lulka, 2004, 2009). This issue emerged in wildlife management as a response to the increase in human-wildlife conflicts worldwide and the accompanying need to prevent the sort of conflict escalations that occur when authorities fail to adequately address the

needs of both humans and wild animals in their attempt to solve the conflict (Carter & Charles, 2011; Knight, 2000b; Madden, 2004b; WWF, 2006; Yeo & Neo, 2010). The concept of cohabitation has emerged as a critique of and as an alternative to the currently prevalent dichotomous (humans versus wildlife) and anthropocentric approach to wildlife management and the use of rather rigid spatial boundaries, fixed data and taken-for-granted categories to manage the respective human-wildlife conflict situations. Instead, its focus is on a dynamic approach to spaces, data and categories, which might result in cohabitation strategies that make use of flexible and dynamic boundaries. This dynamic approach embraces an inclusive process that shifts the focus from a sole focus on humans or wild animals to a process that focusses on the interactions between humans and wild animals. As a result, these human-wild animal interactions, as seen through the lens of the variety of humans (researchers, wildlife managers, policy-makers, local residents) involved in wildlife management practices, become central in thinking about cohabitation strategies and the concomitant spaces, data and categories these entail. Although humans finally set management strategies, this does not mean that wild animals are not involved in these wildlife management practices. In fact, the opposite is true. This conception of cohabitation rejects the presumption that wild animals need to be objectified and, arguably, be acted upon and intensively controlled by humans, as is common in many wildlife management practices (Lorimer & Driessen, 2014; Urbanik, 2012; Wolch & Emel, 1998). Rather, the concept's emphasis is on the 'co' in *co*-habitation, reflecting the view that humans and wild animals share and actively *co*-shape the space where they can both dwell through their ongoing interactions (Bear & Eden, 2011; Buller, 2014; Hinchliffe, 2007; Hinchliffe et al., 2005; Hobson, 2007; Ingold, 2005; Lorimer, 2006a; Lulka, 2004, 2009).

This idea of cohabitation goes beyond humans and wild animals merely living alongside each other. It instead shifts the focus on relationships between humans and wild animals. By accepting the relational status of multi-species encounters, a "*less fixedly human and more dynamic approach to boundaries*" and subsequently of cohabitation might be revealed (Buller, 2014, p. 7). This relational focus also pertains to the ways in which humans and wild animals relate to the landscape where they dwell (Barua, 2014a; Eden & Bear, 2011; Lorimer, 2006a). Such a relational approach to cohabitation and wildlife management, including the intention to approach humans and (wild) animals more symmetrically, has been gaining scholarly attention since the publication of the special issue, 'Bringing the animal back in' by Wolch and Emel (1995), of the Journal of Environment and Planning D: Society and Space. The debates in this issue initiated a call for a 'new animal geography', also termed the 'animal turn' in geography (Buller, 2014). The

main critique in this issue was that, although humans engage with animals in a variety of ways, still, the tendency has been to objectify animals or regard them as inferior to humans (Hurn, 2012). As a result, the emphasis remained on the ways in which humans experience the world rather than accounting and including the presence of animals more fully in social science literature (Urbanik, 2012). The animal turn, to which this thesis contributes, was initiated to explore the complexity of human-animal (spatial) relations. As such, this type of research includes a post-humanist recognition that humans are no longer seen as the only subjects that matter. Rather, it acknowledges animals as an integral part of human lives. The animal turn has encouraged a more symmetrical consideration of the diverse and often unacknowledged roles played by animals in wildlife management, and in human-wildlife conflicts in particular. Research that contributes to this animal turn draws on a variety of scientific fields such as 'more-than-human' geography, anthropology, and Science and Technology Studies (STS). Additionally, to 'bring the animals back' into social science research also requires input from outside the disciplinary boundary such as the fields of ethology and ecology (see also section 1.4 'Research Methodology' about how to account for combining these diverse disciplinary fields). For instance, research from the fields of ethology and ecology has already shifted boundaries of what is considered to be animal intelligence (Bradshaw, 2017; Urbanik, 2012). Since the initiation of the animal turn, a variety of concepts have invited us to think about approaching animals and humans as active beings that actively constitute and create the world and emphasizing the variety of human-wild animal relationships that are constituted in interaction (cf. Lulka, 2009), as well as addressing their more-than-textual, and multi-sensorial character (see below for more detail). These concepts include zoopolis[5] (Donaldson & Kymlicka, 2011; Wolch, 1998), hybridity[6] (Latour, 2007, Whatmore, 2002), the dwelling perspective[7]

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[5] The zoopolis concept by Wolch and Emel (1998) serves as a reintegration of humans with animals and nature in a particular space where both interact (in spatial, political, ethical settings). This idea of a zoopolis was elaborated by Donaldson and Kymlicka (2011) with a central focus on the 'polis' as a political community.

[6] The concept of hybridity emphasizes that everything is engaged in relations. In other words, human-wild animal relations differ depending on specific places as well as *which* human(s) (e.g., a tourist, wildlife manager or local resident) and *which* wild animal(s) (e.g., a young wild animal, or a family) is (are) involved in each encounter (Urbanik, 2012; Whatmore, 2002).

[7] Ingold (2005) defines this perspective as: *"All creatures, human and non-human, are fellow passengers in the one world in which they all live, and through their activities continually create the conditions for each other's existence"*. In other words, he argues that there is no boundary between 'society' and 'nature', but rather they are co-constructed through active processes of movement (Ingold, 2005; Johnston, 2008).

(Ingold, 2000; Ingold, 2005), responsible anthropomorphism[8] (Johnston, 2008), 'multi-species social practices'[9] (see moreover Bear, 2011; Buller, 2015; Eden & Bear, 2011; Law & Mol, 2008), lively biogeographies[10] (Barua, 2014a; Lorimer, 2010a), and multinatural communities[11] (Brettell, 2016; Latour, 2004b; Lorimer, 2012). They have revealed the complex nature of human-wild animal interactions and have pointed to the corresponding multitude of actions taken by the involved humans, wild animals, and the impact of the surrounding landscape. Such human-wild animal-landscape interactions are generally not every day and sustained relationships (as in domestic and livelihood contexts), but rather they are dynamic, intermittent and fleeting (Bear & Eden, 2008, 2011). The previous developments in revealing the complex nature of human-wild animal interactions are important steps in moving towards *co*habitation between humans and wild animals, particularly in terms of allowing wild animals a more prominent role. However, to approach human-wild animal interactions more symmetrically and, in this way contribute to a better understanding of human-wildlife conflicts and, ultimately, achieve cohabitation between humans and wildlife, I will now examine the mutual processes in these human-animal relations in more depth in order to better address the 'co' in cohabitation between humans and wild animals (Barad, 2003; Haraway, 2008).

Thinking of cohabitation in terms of mutuality, such as mutual adjustments and mutual learning by both humans and wild animals, problematizes the predominant acceptance of sole human intentionality and classic, instinctual and automatic stimulus-response processes in human-wild animal interactions. It instead

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[8] Johnston talks about responsible anthropomorphism (2008, p. 646): "*A way of knowing about and knowing with animals not based on our shared sentience, our shared place in the world or any other such abstract philosophical argument, but on our actual relationships, our day-to-day living and working.*"

[9] This conceptualisation also reveals the multiplicities involved in human-animal interactions. For instance, Eden and Bear (2011) emphasize that in angling practices, humans and fish make sense of each other and the world around them through embodied processes of interactions such as learning by doing. These interactions include a multitude of actions by the involved humans (anglers), and the wild animals (fish) and the impact of the surrounding landscape (river and riverbank).

[10] The concept of lively biogeographies offers interdisciplinary connections by drawing the natural and social sciences into conversation to understand how humans and wild animals inhabit a lively earth. For instance, Barua (2014a) uses the term *bio-geo-graphies* to particularly draw attention to the variety of interactions between the bio (human, wild animal) and the geo (landscape), whereby *"landscapes are understood as enfoldments emerging through the activities of humans and elephants/wild animals"* (p. 927-928).

[11] The concept of multinatural communities is used to make multiple natures more immediate through consideration of the skilled, affective and multisensory processes of the interactions between humans, animals and the surrounding landscape (Brettell, 2016; Latour, 2004b; Lorimer, 2012).

emphasizes the embodied processes of interactions, such as learning-by-doing, through which humans and wild animals make sense of each other and the world around them (Barad, 2003; Eden & Bear, 2011; Haraway, 2008). For instance, these human-wild animal interactions involve processes of learning to become sensitive to other registers of communication (Hinchliffe et al., 2005; Johnston, 2008). As a result, humans become more sensitive to multi-sensory forms of communication instead of relying mainly on the verbal and visual modes more typical among humans (Hurn, 2012; Lorimer, 2008a; Mason & Hope, 2014). Such a development may not only reveal unforeseen responses by either human or wild animal in (ongoing) human-wildlife interactions, but also to the implementation of particular management strategies. Management strategies are, of course, inherently human interventions carried out with a particular goal in mind. As such, they are far from symmetrical to start with (see also footnote 2). However, despite the human intentionality in the creation and implementation of particular cohabitation strategies, which are management strategies specifically aimed at cohabitation between humans and wild animals, in practice seeking cohabitation between humans and wild animals requires a conception of cohabitation that incorporates a more mutual approach to understanding human-wild animal interactions. That is, mutuality in understanding human-animal interactions is needed; however, in employing wildlife management strategies this mutuality is problematic because of the human intentionality involved. When viewing human-animal relations with a focus on processes of interactions, it becomes apparent that the animals involved are also able to influence human action and the outcome of interactions through their 'doings' (Hinchliffe et al., 2005; Hurn, 2012; Ingold, 2005; Johnston, 2008; Keul, 2013; Lulka, 2004). For instance, Lulka (2004) demonstrated that in stabilizing the Yellowstone bison herd within the park boundaries, a variety of management strategies had been employed, such as culling, shooting, the use of noise, capture and return. However, the bison learned and adapted to these management strategies by climbing slopes, crossing rivers, following roads and did not 'get it' to stay in the park (Lulka, 2004; Urbanik, 2012). In other words, the bison responded to the employed management strategies in unexpected ways. Based on the outlined relational approach to cohabitation, agency, as employed in this research, is constituted in the interaction among humans, wild animals and landscapes. Agency is therefore regarded as relational and situated (Arts et al., 2013; Barad, 2003; Foucault, 1972; Hinchliffe et al., 2005; Latour, 2004a; Lorimer, 2006a). Cohabitation in this thesis is defined as the mutual processes (e.g., movements, multi-sensory exchanges, learning) between humans and wild animals as they learn to live together. As such, cohabitation relies on an in-depth understanding of the interactions and the complex of activities at stake among human, wild animal and

landscape. Through an understanding of the co-shaping activities performed by humans, wild animals and landscapes, as well as the corresponding use of spaces, data and categories, a variety of (new) ways of cohabitation might emerge.

1.3 Research objective and research questions

As we have discussed in this chapter, cohabitation between humans and wild animals, as a suggested alternative to the intense control of wild animals and the creation of short-term solutions to human-wildlife conflicts, requires a rethinking of current wildlife management practices. Typically, such practices are based on the use of rather rigid spaces, data and categories with respect to wild animals and on management strategies that focus on controlling wild animals and separating them from humans. Cohabitation, however, requires a different approach to the use of spaces, data and categories in its pursuit of strategies that would lead to humans and wild animals living together. Seeking insight into cohabitation and cohabitation strategies is an underexplored area. This thesis attempts to advance insight into wildlife management practices that encourage cohabitation and explore ways in which cohabitation might be achieved. This necessitates both an understanding of these practices and of the relations among human, wild animal and the landscape where they roam. Accordingly, the thesis can also contribute to ongoing debates about how to bring animals back into, and even foreground them in, social science research. This study will therefore not approach human-wildlife conflict management merely as a wildlife problem, involving, for example, a form of pestilence management in which the wild animals are depicted as being the source of the problems that arises, thereby obscuring the human circumstances that may have led to or intensified the conflict between them. Similarly, it does not reinforce *an exclusively* biological understanding of and solutions to human-wildlife conflicts and cohabitation strategies. Neither will this study approach human-wildlife conflict management as a human-human conflict.

Thus, the objective of this thesis is to analyze wildlife management practices in terms of how they deal with human-wildlife conflicts through a focus on the relations among humans, wild animals and the landscape in which they dwell. Specifically, the focus is on which spaces, data and categories are articulated in wildlife management practices in order to better understand the key elements of those wildlife management strategies that contribute to cohabitation between humans and wild animals and to inform further development of wildlife management practices that will bring about cohabitation in theory and practice.

The following general research question and sub-questions guide this thesis:

How can wildlife management practices achieve cohabitation between humans and wild animals?

1. What is the role of space, data and categories in wildlife management?
2. Which cohabitation strategies can be identified in wildlife management practices?
3. In what ways do the acquired insights contribute to a better understanding of managing human-wildlife interactions?

By answering these research questions, this research offers an in-depth understanding of a perspective on wildlife management practices seeking cohabitation between humans and wild animals.

1.4. Research methodology

1.4.1 Interpretive multispecies research approach

An interpretive multispecies approach is employed to answer the research questions formulated in the previous section. This approach enables the exploration of the meanings and practices of 'living with' (wild) animals from a decentralized and symmetrical perspective. In other words, it intends to address the different ways in which humans and wild animals respond to each other as they roam the landscape. An interpretive perspective assumes that we live in a world that can be understood in multiple ways (Van Bommel, 2008; Yanow & Schwartz-Shea, 2006) and provides a way to understand the co-creation of these multiple understandings. Accordingly, for instance, a focus on human and wild animal behaviors such as spatial movements and activities, offers a way to understand this co-creation between humans and wild animals, their various relations and interactions in wildlife management practices (Barua, 2014c; Buller, 2015; Hodgetts & Lorimer, 2015). This interpretive multispecies approach incorporates various genres of data, including words, numbers, sounds, smells, and images, which enables me to investigate the diversity of human-wild animal interactions and offers a multifaceted understanding of wildlife management practices (Schwartz-Shea, 2006). Applying an interpretive multispecies approach means that all participants in the research, including the researcher, construct and interpret issues as they seek to make sense of the world around them (Yanow, 2000). Because in interpretive research the researcher is part of the research process, critical reflection on one's own identity in relation to the fieldwork is required. For example, how I was perceived by the respondents and the expectations they had of me. This includes reflection on the possible role of my background in ecology, of being a relative novice in the respective wildlife

management practices, and of being a female among mostly male respondents. Examining these reflections in the field contributed to in-depth insight into the respective practices I observed while I gained (field) experience (Shehata, 2006).

The methodological challenge of this research is to include and account for animal presences in more detail and configure animals as co-participants in investigating human-wildlife conflict situations. This entails reaching beyond the common and usually abstract categorizations of wild animals such as ordering them by species and function. It instead requires a richer description of what is going on in diverse places through an examination of their spatial occurrences, behaviors, and – if possible – discrimination among particular individual wild animals or particular groups of wild animals to understand their lifeworlds, including their entanglement with humans and the landscape (Buller, 2015; Hodgetts & Lorimer, 2015). Because the emphasis of this research is on human-wild animal interactions, this research uses a *multispecies-ethnography* (Buller, 2015; Kirksey & Helmreich, 2010). Thereby methodologies are employed with an emphasis on observing, interviewing, and textual analysis of humans (researcher and participant) who interact with or have contact with particular wild animals. Since it is not always possible to directly observe wild animal behavior in relation to human behavior, that is, to directly observe human-wild animal interactions (in conflict situations), I encouraged the other research participants (researchers, wildlife managers, policy-makers, local residents) to talk about how they approached wild animals, how they were affected by them and how they interpreted their own impact on the wild animals' behavior. To elicit their stories, I made use of in-depth interviewing (see section 'data collection'), to which I refer as "*engaged, active or collaborative interviewing*" (Rapley, 2007). This mode of in-depth interviewing includes probing to create a reconstruction of the human-wild animal interaction (or conflict) from beginning to end, including possible solution(s), and the role of the respondent as well as other humans and wild animal(s). Data collection and data analysis with respect to these reconstructions focused on key-incidents (see section 'analysis' for more detail). In addition to the above described way to investigating human-wild animal interactions, I also included direct observations of *the wild animals*[12] by the researcher and made

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[12] These included descriptive observations, rather than the numerical observations as are common in ethological and ecological studies, of the signs on the respective wild animals in interactions with the human participants of the research, including myself. Direct observations of wild animal behavior in response to human activity were also made.

use of existing ethological and ecological knowledge[13]. The latter included interpreting the tracking and other spatial-ecological monitoring of wild animals through space as has been performed by wildlife managers and wildlife researchers who were part of this research, as well as by other researchers, for example when the topic has been addressed in the scholarly (ethological and ecological) literature. I used these interpretations not in isolation but placed them in the context of the respective wildlife management practices and, as such, they served in addition to the other ethnographic findings to further the understanding of the (observed) human-wild animal interactions.

This interpretive multispecies approach, along with the multispecies-ethnography employed, implements a relational approach to human-wild animal-landscape interactions. It also acknowledges that both humans and wild animals are participants in the research process.

1.4.2 Case selection

First, the various conceptions of space and the role of data in the categorization of wild animals were further investigated through an examination of the category 'invasive' in science, policy and wildlife management. The following in-depth investigations of human-wildlife conflict management were built on the insights gained. Subsequently, two human-wildlife conflict cases were selected to investigate the ways in which wildlife management practices address human-wildlife conflicts and seek cohabitation between humans and wildlife. The two cases were selected to complement each other with regard to our understanding of human-wildlife practices (Flyvbjerg, 2006). The first case is about black bear management on the Colorado Front Range of the Rocky Mountains in Colorado, USA. The second case concerns wild boar management at the Veluwe, the Netherlands. The two cases differ in several respects, including species, country of investigation, country-specific political and cultural settings, altitude, ecosystems, etc. However, they were complementary both in terms of species characteristics that have been accommodated in particular wildlife management strategies as well as in terms of what was previously known about the design of the specific wildlife management

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[13] Ethology refers to the study of animal behavior, mainly through observations. Ecology refers to the study of how living organisms (microbes, plants, animals) interact with their natural environment, with an emphasis on the complex and diverse relationships of these organisms with their environment. Behavioral ecology, also referred to in this thesis, is regarded both as a sub-discipline of ethology and a sub-discipline of ecology and focusses on how living organisms (microbes, plants and animals) react to biotic and abiotic factors in their environment: physiology, morphology and behavior. Topics include, e.g., territoriality and foraging behavior.

practices. There were five distinctive selection criteria for this research. The first was that both cases must address conflicts between humans and wild animals and that these should be conflicts that needed to be controlled, solved, and preferably prevented. It was also necessary that in both cases there was a desire to find a way for humans in the surrounding areas to live together with the wild animals in question. Second, another criterion involved a contrast: in the black bear management case, humans were known to be addressed as part of the management strategies employed. On the other hand, in the wild boar management case, it was known that the emphasis was on managing the wild boar population, without the involvement of humans. Third, the cases varied not only by species, but, more importantly for this study, in the way these species live: black bears tend to be solitary animals, with the exception of mothers and cubs, while in contrast wild boars tend to live in groups. These differences in behavior have a direct impact on the application of particular wildlife management strategies. Fourth, both species are known to be extremely adaptable to a wide array of environments and are commonly considered to be omnivorous species. These characteristics make it very likely that they would attempt to live among humans, which makes it desirable to find a means of encouraging cohabitation through the implementation of particular wildlife management strategies. Fifth, the cases were also selected on the basis that they were both informed by a broad western conception of wildlife management practices, that is, one in which science rather than cultural beliefs is dominant (cf. Kpéra et al., 2014).

1.4.3 Data collection

The methodological approach employed in this research is based on the idea that shared experiences, and the abilities, achievements and consciousness of animals, are both 'hidden and expressed' in the material aspects we can observe (Gooch, 2008; Hurn, 2012; Ingold, 2000; Lorimer, 2006a; Urbanik, 2012).To address wild animals more prominently in the data collection and data analysis, I focused on the multi-sensory aspects (visual, olfactory, auditory, tactile) of human-animal interactions in terms of their materiality, their function as a guide to behavior, and their general impact on the lifeworlds of both humans and wild animals. Data collection included the following: in-depth interviews (taped and transcribed, noted); participant-observations (noted); focus groups (taped and transcribed, or taped and noted); occasional relevant meetings (noted); and textual analysis of key scientific, policy, and educational documents. In addition, I reflected on my own role, as a researcher and as participant-observer in the research, in particular by making notes throughout the fieldwork, including notes about interpretations made during the fieldwork. Next, I will discuss how I examined the category of 'invasive' wild

animals and how I engaged in both black bear and wild boar management practices to collect the required data.

The data employed to examine the construction of invasiveness in science, policy and wildlife management were obtained from a literature study. Therefore, first, scholarly literature was collected that discussed 'invasiveness' in scientific practices as well as the definition of invasiveness. Second, policy documents were collected that addressed invasive species. I restricted this collection to two policy levels, country and regional, and two spatial scales, the Netherlands, Europe, and the USA, North America, to take into account a variety of spaces and data that might be involved in categorizing invasive species. Third, two wildlife management plans were selected that addressed invasive species that were declared invasive by the central government (wild boars in two areas of the USA) and two wildlife management plans that addressed the management of arguably invasive species (the brown bear in the Pyrenees, France, and the wolf in Yellowstone National Park, USA). This variety of management plans was employed to avoid a preconceived scientific or policy perspective regarding invasive species. The results of this study further informed the data collection of the two cases.

The black bear case study data were collected in the summer of 2012 during a two month stay on the Colorado Front Range of the Rocky Mountains in Colorado, USA. The wild boar case study data were collected between 2010 and 2016, with a majority of the material collected during field work in 2010 and 2011 at the Veluwe, the Netherlands. In both cases, *in-depth interviews* were held with wildlife researchers, wildlife policymakers, wildlife managers and local permanent residents (37 in the black bear case, 31 in the wild boar case) (see Appendix I). The emphasis in the interviews was on the differing perspectives of the interviewees concerning human-black bear and human-wild boar management, including their own interactions with black bears and wild boars, as well as other human-black bear/wild boar interactions, interactions with other humans in the respective wildlife management practices, and their experiences generally (with living) in bear country or living with wild boars. Recent examples of management interventions were also explored during the interviews. A similar strategy was used in the *focus groups* (three in the black bear case, four in the wild boar case) with local permanent residents in which the emphasis was on the collection of local stories concerning human-black bear and human-wild boar management. The focus group sessions were guided by the use of five (wild boar case) or six (black bear case) propositions (see Appendix II). In both cases, *participant-observations* were conducted (five days in the black bear case, and 11 wild boar counting and three wild boar hunting events) in which I accompanied wildlife managers in the field in their daily practice, observed actual

occurrences of human-black bear interactions and human-wild boar interactions, and gained insight into their experiences with black bears and wild boars in the particular regions. I also took into account and interpreted the signs left by the respective wild animals (visual, olfactory, auditory, tactile) and noted the variety of such signs made use of in relation to the implementation of a management strategy. These participant-observations also included informal ethnographic interviews (Delamont, 2010; Soss, 2006). Additional – incidental – meetings and visits in the areas with local residents, such as attending a meeting of a local volunteer group involved in black bear issues or wild boar related topics, provided complementary information used to assist in the reconstruction of particular key-incidents (see section 1.4.4 'Analysis' for details) or to gain a better understanding of the respective management practices. Finally, *documents* were collected that were relevant to or specifically used in the management practices such as policy plans, management plans, conflict forms, books, websites, monitoring reports, educational leaflets, media attention (both about actual conflicts and educational), and research (area specific research, scientific and non-scientific research). These documents not only served as back ground information for the respective wildlife management practices and local or regional characteristics, but also provided in-depth insight into the processes of managing the respective human-wild animal interactions. The ethological and ecological knowledge, in particular, added a multispecies as well as an interdisciplinary angle to the understanding of the (observed) human-wild animal interactions (as discussed in section 1.4.1 'Interpretive multispecies research approach').

1.4.4 Analysis

The data analysis of the categorization of invasive wildlife in scientific, policy and wildlife management practices was concentrated on the role of spaces and data on the formulation of invasiveness in each domain. The data analysis in both the black bear and wild boar cases can be described as an on-going and iterative process, one that began with the collection of the first data and, subsequently, made use of an increased understanding of each wildlife management practice (Yanow, 2006). After the field data were collected, the transcripts and records were analyzed with a specific focus on 'key incidents'; these include 'key' human-wild animal interactions that were found in the material (Emerson, 2010). These help to reveal the detailed interactions, including movements, left traces and behavior, between humans and wild animals in a particular setting (Buller, 2015; Law & Mol, 2008). Subsequently, the implementation of management strategies in these key-incidents on the part of the wildlife manager, including the potential role of spaces, data and categories in these, was added in this analytical strategy. To further the understanding of these

interactions, I correlated the described processes with available ethological and ecological knowledge about black bears and wild boars in general as well as with other available accounts of prolonged human experiences with black bears and wild boars in the respective regions and with my own experiences and observations. Next, I focused on the landscapes involved in relation to the described interactions and activities of the involved humans and wild animals to address their various relations, spaces and movements (Barua, 2014c; Buller, 2015; Law & Mol, 2008; Locke, 2013) such as examining characteristics of the landscape that are shared by both and might have initiated human-wild animal interactions. Subsequently, the human-wild animal interactions and corresponding management strategies were reconstructed based on the accounts of the various participants in the interactions (e.g., homeowner, wildlife researcher, wildlife manager), including my own, and each interpretation of the animals' behavior. Interpretation of animal behavior also included interpretations obtained from the scholarly ecological and ethological literature, and other documents such as educational material. The intention of this analysis was to construct a picture of human-wild animal interactions related to their endeavor to cohabitate.

For reasons of anonymity, given the sometimes tense situations arising in human-wildlife conflict management, the participants have been described by their relation to wild boar management (wild boar manager, counter, hunter, policymaker, farmer, researcher, local resident), or they have been assigned pseudonyms. The names and genders were arbitrarily chosen in each chapter, and the actual person that a name represents is not necessarily the same person and/or gender throughout the text. For clarity in the writing, additional 'voices', for example the voice of a colleague, have sometimes been added. The wild animals in the text are usually referred to as '(s)he' (when the gender is not known) and 'he' or 'she' when the gender is known.

1.5 Thesis outline

This section provides the outline of this article-based thesis. Chapters 2, 3, and 4 are written as articles for peer-reviewed journals. These articles are co-authored; however, I was the main researcher of all of the articles. Chapter 5 is a single-authored, peer-reviewed book chapter. The outline of this thesis is as follows:

The introduction (*Chapter 1*) has provided an overview and background of the research topic; the initial conceptual framework of this research, which is further developed throughout the chapters; the research objective and research questions; and the methodology underlying this research.

Chapter 2 presents the dynamic, context-specific nature of the categorization of invasive species. In particular, in this chapter, the concepts of category, space and data are used to analyze invasiveness in three different domains: science, policy and wildlife management. The chapter demonstrates that in the categorization of invasives, human-animal interactions are important because these interactions inform and constitute the actual management of invasives. This chapter addresses the first research question about the role of space, data and categories in wildlife management. Research questions two and three are addressed in chapters three, four and five.

Chapter 3 presents the results of the black bear management case. In this chapter, ideas of cohabitation in human-black bear management practices are further explored. The concept of multi-sensory writing and reading is introduced to analyze the dynamic and interactive spatial interactions among humans, black bears and the landscape. The chapter demonstrates that the interactions between humans and black bears need to be put central in pursuing *co*habitation between both, and in that context, black bears must be considered participants in wildlife management practices.

Chapter 4 presents the results of the wild boar management case. In this chapter, attention is drawn to the affective relationships between humans and animals – inevitably formed in the management practices of producing data – and the production of non-representational knowledge. In this chapter, a multinatural approach to wildlife management and research is developed that builds on an acknowledgment of mindedness as a feature of individuals, collectives and landscapes.

Chapter 5 presents a comparison between the two cases. In this chapter, the dynamics of boundary-drawing in both wildlife management cases is explored. The need for boundaries in setting up management strategies is discussed, as well as what kind of boundaries that might be needed for wildlife management practices in their aim for cohabitation. In the chapter, a distinction is made between strategies of alignment and strategies of confinement, and it is argued that both are needed to pursue cohabitation between humans and wild animals.

Chapter 6 presents the conclusions of this research and includes further discussions. In this chapter, the research questions are answered, and the chapter includes a theoretical and methodological reflection and discussion. Furthermore, some broader contributions of this research are presented.

Chapter 2

Invasive species:
The categorization of wildlife in science, policy, and wildlife management

Abstract

Species categories commonly used in nature conservation, such as protected, endangered, reintroduced, or invasive, are open to various interpretations that can result in diverging and sometimes serious consequences. This is vividly apparent with respect to invasiveness because the categorization of species and individual animals as invasive impacts on how they are treated in practice. This chapter demonstrates how different constructions of invasiveness in science, policy, and wildlife management can be traced back to different assessments of the origin, behavior, and impact of the invasives. Specifically, the focus is on the different conceptions of *space* and the role of *data* in the *categorization* of invasives. We find that, in science and policy, invasiveness is constructed mainly in terms of the origin and impact of invasives but that these domains differ in how they treat space in their assessment of origin: whereas science uses ecological spaces, such as biogeographical regions, to assess whether a species belongs to, or is invasive in, a certain area, policy uses policy spaces such as countries or states to do so. In assessing the impact of invasives, science argues about including it in its definition, whereas policy requires detailed data about ecological, societal, and economic damage in order to take action. In wildlife management, the focus in the construction of invasiveness shifts from origin and impact to behavior of invasives. This requires detailed data about where the invasives are, where they are going, and what they are doing. By showing the dynamic and context-specific nature of the construction of invasiveness, the chapter contributes to ongoing research about classifications of nature, their difficulties and ambiguities, and their implementation and consequences in practice.

Invasive species: The categorization of wildlife in science, policy, and wildlife management

2.1 Invasiveness: a contested topic

The issue of invasive species is high on the international conservation agenda and subject to debates and contestations. These debates focus on how to define invasive species and are connected with preferred courses of action considered necessary to mitigate the threat of invasive species for biodiversity conservation (Colautti & MacIsaac, 2004; Colautti & Richardson, 2009; Davis & Thompson, 2000; Valéry et al., 2008). Indeed, much of the scientific literature about invasiveness argues for the importance of the control or eradication of invasive (non-native) species in order to protect native species (Clavero et al., 2005; Schüttler et al., 2009; Simberloff, 2005). This body of literature has itself become the topic of scientific debate between, on the one hand, social scientists who criticize the use of war metaphors and xenophobic or racist motivations in the justification of eradication and control measures, and, on the other hand, invasive species biologists who deny these accusations (Hettinger, 2001; Larson et al., 2005; O'Brien, 2006; Peretti, 1998; Simberloff, 2003; Subramaniam, 2005).

In response to these – often rather polarized – debates, a growing body of social science literature has demonstrated the existence of different perceptions of invasiveness in science, policy, conservation management, and society (Caplat & Coutts, 2011; Head & Muir, 2004; Heger et al., 2013; Larson, 2005, 2007a; Peretti, 1998; Robbins, 2004; Sagoff, 2005; Weeks & Packard, 2009; Zisenis, 2012). For example, several studies have shown that citizens often have different views than scientific experts or management professionals on invasives and what should be done about them (Colautti & MacIsaac, 2004; Larson, 2007a; Robbins, 2004; Weeks & Packard, 2009). In addition, Heger et al. (2013) have shown that, even within science, different perspectives on and definitions of invasiveness prevail, ranging from historic-biographical, to conservation-oriented, to ecological-evolutionary perspectives. These different perspectives are important because they are not just about definitions but also about action: deciding on what actions to take depends on the categorization of invasives – which need to be controlled – and their demarcation from non-invasives – which often need protection[1]. In this context, social scientists

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[1] Within the current debates about invasiveness and invasive species, we approach invasiveness in a very broad sense, whereby amongst other things both native and non-native species could be considered as invasive.

have started to outline guidelines for achieving more clarity in communicating about invasiveness and designing legitimate management strategies (e.g. Arts et al., 2012; Caplat & Coutts, 2011; Heger et al., 2013; Larson, 2005, 2007b).

This chapter contributes to a further understanding of the different perspectives on invasiveness and their implications by offering an analysis of the different ways in which invasiveness is constructed in science, in policy, and in wildlife management practices. We focus specifically on three important criteria for the categorization of invasives: origin or nativeness – where did particular wildlife come from and does it belong here?; behavior – where is it, what is it doing, how is it moving or spreading?; and impact – is it causing damage to nature or society? (Head & Muir, 2004; Zisenis, 2012). In light of our discussion above, it is not surprising that these criteria are assessed differently in different practices, resulting in different categorizations of invasives and concomitant courses of action. For example, in some cases, invasiveness refers to species that are non-native, or alien, to an area, regardless of whether they rapidly colonize an area or have a negative impact on their environment (Richardson et al., 2000), whereas, in other cases, it refers to species that are considered damaging, irrespective of their origin (Davis et al., 2011). Thus, by presenting empirical detail about these three criteria, we gain an in-depth understanding of the different constructions of invasiveness and how these differ or overlap in science, policy, and wildlife management.

By detailing the construction of invasiveness not just in science but also in policy and in wildlife management, the chapter brings in the human and practical dimensions of invasiveness, including the importance of human–animal interactions. Building on studies in geography, amongst others, about human–nature relationships (Campbell, 2000; Hinchliffe et al., 2005; Ingold, 2005; Turnhout et al., 2013; Waterton, 2002), we aim to elucidate how, in wildlife management practice, the construction of invasiveness is not a distant academic or bureaucratic undertaking but involves, and is shaped by, multiple interactions between humans and invasives. This will enable us to demonstrate the dynamic and contingent character of invasiveness and illustrate the ways in which, in the process of categorization, wildlife managers and invasives continuously *"make each other"* (Hinchliffe, 2007, p. 176).

The next section presents the theoretical and methodological framework of the study. We focus specifically on three central concepts that we use to analyze the different constructions of invasiveness: categories, spaces, and data. To be more specific, our focus is on how different concepts of space and data affect the categorization of species or individual animals as invasive. Taken together, these

concepts help us understand how different actors assess the origin, behavior, and impact of invasives. This is followed by three empirical sections about the construction of invasiveness in respectively science, policy, and wildlife management, and the chapter closes with a discussion and conclusion.

2.2 The construction of invasiveness: categories, spaces, and data

Debates about invasiveness show that different actors have different ways of interpreting and assessing the origin, behavior, and impact of species or individual animals. These three criteria are informed by the occurrence – spatiality – of the species or individual animals and by the data used. This means, for instance that species or individual animals can be categorized as native or non-native depending on the assessment of their origin, which in turn is based on specific concepts of space (nation state, management area, ecosystem) and different types of data (population size, reproduction rates). Thus, different approaches to space and data may result in different categorizations of the same species or individual animals by different actors regarding not only invasiveness (invasive or non-invasive), but also other species categorizations (e.g. as protected, reintroduced, or endangered).

We start with the concept of category. Species categorizations, such as threatened, protected, reintroduced, endangered, or invasive, have emerged within the field of wildlife and habitat conservation for purposes of organization. These categorizations serve to make decisions about conservation priorities and management. More generally, we can say that, without categories, knowledge and action are impossible (Bowker & Star, 2000; Jones, 2009). Although categories of nature are often seen as derived directly from nature itself, they are manmade (Dean, 1979). However, as in the case of invasiveness, fitting the complexity of nature into distinct categories is not unproblematic as both nature itself and the categories are often ambiguous and multi-interpretable (Morris, 2004; O'Rourke et al., 2012; Soini & Aakkula, 2007; Turnhout, 2009; Waterton, 2002).

Additionally, it is important to recognize that categorization involves bootstrapping difficulties (Bowker, 2000). Despite the common view of categories as fixed containers that pre-exist the items that they intend to include, in practice, the boundaries of categories and the items that are classified into them are mutually constitutive (Jones, 2009). *"The making of a category involves defining standards and criteria and in the process, the items that go into it are named, labeled, and remade as belonging to the category. Just as the development of [categories] requires preconceived ideas about [the items] that need to be classified, [the identification of these items] requires the existence of categories and classification*

systems" (Turnhout & Boonman-Berson, 2011, p. 35). Consequently, categories such as invasive are not static entities with clear-cut, self-evident boundaries and definitions, but ambiguous, multidimensional, and dynamic (Bowker, 2000; Geertz, 1973; Gieryn, 1983; Jones, 2009; Morris, 2004). In this chapter, we analyze how species and individual animals are categorized as invasive and on what grounds, focusing specifically on the role of space and data in these categorizations. Space is the second central concept in our analysis. Conceptions of space are very important in categorizations of nature (Hinchliffe, 2007; Jerolmack, 2008; Payés et al., 2013; Selman, 2009). In the case of invasiveness, spaces of origin for example, or the characteristics of the spaces in which species or individual animals dwell, all influence how they are categorized. The categorization of invasives thus depends on where they are, where they came from, and what they do in these areas. Spaces can refer to ecological spaces, demarcated for example by geographical, climatic, or ecological criteria. In this case, species or individual animals will be categorized as invasive if they move from their native habitats to sites with different ecological characteristics, or if they cross geographical boundaries such as a mountain range, ocean, or river. Spaces can also refer to policy spaces such as countries or states, or to the designation of specific areas as conservation areas or as urban areas. In this case, species or individual animals will be categorized as invasive if they move from one country to another or from a conservation area to an urban area. Time needs to be explicitly included here, as the origin of species is very often also determined with reference to a specific date. If a certain species can be shown to have inhabited a certain area from which it later disappeared, it can be categorized as native to that area depending on the time period between absence and re-occurrence and on possible climatic or ecological changes that may have occurred during that time period. Thus, the invasives and the spaces in which they dwell continuously interact: *"space is always in a process of becoming, it is always being made, it is never finished, never closed"* (Hinchliffe, 2007, p. 84).

The third main concept to inform our analysis is data. We refer here to the information collected and used in order to assess the origin, behavior, and impact of the invasives. Data often come in the form of numbers that result from direct measurements in the field (the number of species present in a certain area, movement or reproduction rates, habitat characteristics, etc.). Data are often treated as universally valid and unquestioned facts (Hinchliffe, 2007; Porter, 1995). For example, when a small number of a specific species are present in an area and they meet certain characteristics (e.g. low reproductive rate), the species is categorized as endangered. In contrast, when there are many and their reproductive rates are high, they may end up in the invasive category. However, in practice, deciding on these

issues is rarely self-evident because the available data often do not meet the requirements of the users: data easily become outdated because they have been collected in the past with specific questions and intentions in mind and are unable to answer possible new questions that may arise in the future. Furthermore, the presentation of these data in reports involves specific interpretations with specific audiences in mind, and this also structures the ways in which they may or may not be used. Thus, data are inevitably tied up with meaning, and each step in the production, dissemination, and use of data involves the renegotiation and reinterpretation of what these data mean. This means that locally collected data change shape and meaning when they enter different knowledge domains (Latour, 1999; Morris, 2004). Consequently, the production and use of data are important factors in the construction of invasiveness as they will result in different interpretations and assessments of the origin, impact, and behavior of species.

As argued so far, the concepts of space and data are crucially important in understanding how species and individual animals are categorized. We therefore use these concepts to offer an analysis of the construction of invasiveness in science, policy, and wildlife management. Specifically, we address the following set of interconnected research questions: How is invasiveness constructed in science, policy, and wildlife management?; What differences and similarities can be identified?; How can these differences and similarities be understood in terms of the concepts of space and data used to categorize invasives and assess their origin, behavior, and impact?

Our methodological strategy is as follows: For each of the three domains under study (science, policy, and wildlife management), we analyzed the different constructions of invasiveness and the different assessments of the origin, behavior, and impact of invasives underpinning these constructions. We did so by paying specific attention to the question of what concepts of space and data are taken into account in categorizing species or individual animals as invasive. To analyze the science domain, we used materials from the scientific literature in which the definition of invasiveness is debated (especially the journals *Biological Invasions* and *Diversity and Distributions*). For the policy domain, we analyzed relevant policy documents dealing with invasive species at two different levels and different spatial scales (country level: the Netherlands, regional level: Europe and the USA). For wildlife management practices, we analyzed two wildlife management plans for the invasive wild boar in two areas of the USA, in which the actual management of declared invasive species is described, and two cases (brown bear and wolf) in which the animals are not declared invasive by central government, but argued by different actors to be so. Including the latter two cases made it possible to show the differences

in constructions, without a predetermined focus on either a scientific or a policy-motivated conception of invasiveness.

2.3 The construction of invasiveness in science

The scientific literature on invasiveness reveals a large variety of different definitions of invasiveness, as illustrated by the following four examples:

1. Invasions of exotic species into new geographical areas sometimes occur naturally and without human agency. However, human actions have increased this trickle to a flood […]. Many introduced species are assimilated into communities without much obvious effect (Townsend et al., 2000, p. 500, in Richardson et al., 2000, p. 102).
2. Invasive should be used with reference to the 'biogeographic/demographic' status of a species without any connotation of impact (Richardson et al., 2000, p. 102).
3. A biological invasion consists of a species' acquiring a competitive advantage following the disappearance of natural obstacles to its proliferation, which allows it to spread rapidly and to conquer novel areas within recipient ecosystems in which it becomes a dominant population (Valéry et al., 2008, p. 1349).
4. An 'invasive non-native species' (INS) is a species that meets both of the following criteria: (1) it was not present in a given region before some reference time period (i.e. non-native); and (2) it exhibits the ecological behavior of rapidly reproducing, spreading and displacing extant species without direct human assistance (i.e. invasive) in its new region (Evans et al., 2008, p. 523).

These examples show that there is no agreement on what is meant by invasiveness in science. Some emphasize the origin of the species by reference to a certain geographical area (nos. 1, 2), even specified by a time period (no. 4), or do not refer to the origin at all (no. 3). Each example stresses certain biological characteristics that refer to the behavior of invasive species, such as – rapidly – spreading (nos. 1, 2, 3, 4) and outcompeting other species (nos. 3, 4 [criterion 2]). The impact of invasive species is not relevant to some (nos. 2, 3) or is limited to ecological impact when they displace native species (no. 4). This lack of clarity in defining invasiveness has a long history starting with Elton (1958) classic book on invasions, which does not define the term.

Many scientific debates about the construction of invasiveness use origin as an important criterion. Specifically, to be considered as invasive, species must be of

external origin – as signified by the use of categories such as 'alien', 'exotic', 'introduced', and 'non-native'(Richardson et al., 2000). Categorizing species as invasive or not, based on origin, generally requires reference to ecological spaces: native and non-native spaces. The ways in which native and non-native spaces are demarcated varies, ranging from references to ecosystems, the presence of geographical barriers, or the distance that invasives have traveled – which is decided on a case-by-case basis by type of species or their mode of travel (Valéry et al., 2008). In some cases, the origin and subsequent invasiveness of species is determined by spaces such as socio-political regions, as in the case of the (European) wild boar which is considered invasive in the country of Brazil (Deberdt & Scherer, 2007). These references to space are often quite ambiguous, leaving unclear what criteria were used to categorize species as invasive, as illustrated by the example of the American mink. The American mink is not considered invasive in the country of Chile. However, there is one exception: the Navarino Island, Cape Horn Biosphere Reserve (Schüttler et al., 2011). In this specific place, which is demarcated using ecological and geographical criteria – it is an island – as well as policy boundaries – it is a biosphere reserve – the American mink is considered to be invasive. Moreover, numerous interpretations of historical dates can be identified in different spaces. For example, the state of Hawaii uses the year 1830 (Cowie, 1998) as a baseline and considers all new species that have entered Hawaii after that data as invasives. The Great Lakes area (USA) uses 1810 (Ricciardi, 2001) and the San Francisco estuary uses 1850 (Cohen & Carlton, 1998).

This variety in references to space, and the different criteria used to demarcate native and non-native spaces, clearly illustrate that the issue of origin is not yet resolved in the scientific literature, resulting in diverging categorizations of invasives (Colautti & MacIsaac, 2004; Valéry et al., 2009). This problem is aggravated by a lack of data. Often, there are no reliable data about species' presence, particularly in time and space, making it very difficult to objectively assess where species originally belong and what species are to be considered as native (Colautti & MacIsaac, 2004; Davis & Thompson, 2000; Valéry et al., 2013; Zisenis, 2012).

Although origin appears to be the most important criterion used in the construction of invasiveness in science, behavior and impact can also be identified. In assessing the behavior of species (which is also commonly phrased as biological phenomena, biological characteristics, or ecological processes of invasion), space seems to be less important, but data become extremely important. These include for example data about colonization rate, reproduction rate, travel distance, population size, and the number of species in a specific place (Simberloff, 2005). Particularly data about the potential to rapidly colonize a large area and become locally dominant

is an important factor in the scientific categorization of invasiveness (Valéry et al., 2013). For example, the White Cypress Pine is a species that, although native to Australia, is categorized as invasive due to dense regeneration in areas where it did not previously occur (Farquharson et al., 2009).

The colonization of areas by species is considered to be a problem when this has a negative impact on the ecosystems they invade or when they cause damage to biodiversity, human health, ecological services, and economies (Bremner & Park, 2007; Mack et al., 2000). Data that demonstrate such damage will in these cases be used to categorize these species as invasive. Sometimes, the scientific debate about the impact of invasives criticizes the dominant use of origin as the main criterion in the construction of invasiveness. For example, Davis et al. (2011) argue that conservationists should focus on the functions and effects of species and the extent to which they are seen to benefit or harm biodiversity, rather than on the native-alien dichotomy only. Scholars holding this view argue that a species must have a major impact on the ecosystem or community in which it spreads in order to be considered invasive. This impact can be economic, ecological, or social, and is mainly considered to be negative. For example, wild boar in Brazil cause agricultural, social, and ecological harm by rooting up soils, by feeding on potato, squash, and corn, by triggering erosive processes, by altering the physical and chemical characteristics of the soil and thus reducing plant growth, and by transmitting diseases (Deberdt & Scherer, 2007). However, the criterion of impact is not without its own problems, and the assessment of impact is subject to critical scrutiny and debate. As in the assessment of behavior, data are crucial to assess impact. The kinds of data included range from numbers or percentages of species loss to economic costs (Davis & Thompson, 2001). Apart from problems with data availability, the assessment of impact requires the making of judgments on what constitutes negative or major impact. There is no consensus within the scientific community about how impact should be measured and evaluated. There are no accepted standards for what constitutes low, high, or major impact, and there is no agreement about how these categories are defined or about the spaces or places in which this impact occurs. Because of these disagreements, some scientists are of the opinion that impact is not a suitable criterion for invasiveness (Valéry et al., 2008). For example:

> [Impact is a] subjective criterion and is dependent on human values that vary substantially from person to person. (Daehler, 2001, p. 101)

> The primary practical reason [for incorporating impact in the definition of invasiveness] is that, outside of the discipline of ecology, 'invasive species'

are usually explicitly defined on the basis of their impact. (Davis & Thompson, 2001, p. 206)

These quotes make clear that, although questions of impact are considered to be highly relevant for the invasive species debate, there is no consensus about the usefulness of impact as a criterion for the construction of invasiveness. Instead, scientific discussions about invasiveness seem to focus mostly on the issue of origin and the spaces used to categorize invasives and to demarcate native from non-native spaces. Thus, the construction of invasiveness in science focuses predominantly on the assessment of origin – based on the demarcation of native and non-native spaces using data about the original presence of species – and behavior using data about the ecology of species.

2.4 The construction of invasiveness in policymaking

The second domain in which invasiveness is constructed is policy. To understand the construction of invasiveness in this domain, we studied policy documents from the Netherlands, the EU, and the USA. The subsequent analysis highlights some important differences between the scientific construction of invasiveness as discussed in the former section and the construction of invasiveness in policy. These differences relate to the use of spaces and data in the categorization of invasives and reflect differences in the assessment and relative importance of the criteria of origin, behavior, and impact. First, we offer three definitions of invasiveness taken from key policy documents for the Netherlands (Beleidsnota Invasieve exoten), the EU (European strategy on invasive alien species), and the USA (Executive Order 13112 Invasive Species).

The Netherlands:

An exotic species is a non-native plant, animal, or organism which cannot reach the Netherland on its own, but arrives in Dutch nature through human intervention (transport, infrastructure) [...] An exotic species is invasive when it is established and grows explosively. Invasive exotic species can become threatening to native biodiversity, health, and safety. Because of this, they can cause society much trouble and lead to economic losses. (Verburg, 2007, p. 1)

Europe:

[An invasive alien species is] an alien species whose introduction and/or spread threaten biological diversity. [An alien species is] a species, subspecies or lower taxon, introduced outside its natural past or present

distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce. [Introduction refers to:] the movement by human agency, indirect or direct, of an alien species outside of its natural range (past or present). This movement can be either within a country or between countries or areas beyond national jurisdiction. (Genovesi & Shine, 2004, p. 14)

USA:

Invasive species means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.
Alien species means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.
Native species, means with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. (The White House, 1999, p. 6183)

Native species, means with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. (The White House, 1999, p. 6183). The categories used to describe invasives in the above definitions – alien, exotic, non-native – all point to the importance of origin as a criterion to construct invasiveness. However, in contrast to the construction of invasiveness in science, these documents do not use ecological spaces to assess the origin of species, but policy spaces. The question of whether or not a species is characterized as invasive generally depends on whether it has crossed the border between the country of origin and the country that it is invading. For instance, the Dutch policy plan is very clear in its reference to policy spaces because, as the quotation from the Netherlands shows, the determining factor in defining invasiveness is arrival in *"Dutch nature"* (Verburg, 2007, p. 1). The European plan uses policy spaces when it describes the importance of preventing invasive alien species from entering countries and advocates the use of border controls and quarantine measures (Genovesi & Shine, 2004). In the case of the spontaneous spread of invasive alien species in particular (Genovesi & Shine, 2004, p. 37), it is stated that *"one country's mitigation could well be a neighboring country's prevention"*. Within Europe, several control measures aimed at the early detection of specific species – including the American mink and the grey squirrel – and rapid response in terms of capturing and eradication measures have been set up to control these species within the countries they have already invaded and to prevent them from invading new countries (Bonesi & Palazon, 2007; Genovesi & Shine, 2004). In

the USA also, policy spaces are used in the categorization of invasives (National Invasive Species Council, 2008). The example of the European starling *Sturnus vulgaris* L., which is expanding in both Europe and the USA but is only categorized as invasive in the latter, illustrates the importance of policy spaces to assess the origin of invasives (Feare, 1984 and Pascal et al., 2006 in Valéry et al., 2008).

These policy plans not only focus on origin but also use behavior and impact as criteria to construct invasiveness. Take for example the following quotations from, respectively, the Netherlands, the EU, and the USA:

An exotic [species] can threaten biodiversity and the ecosystem by: outcompeting native species; infection, predation, and infestation of native species; hybridization by which typical (genetically) distinct native (sub)species disappear. (Verburg, 2007, pp. 2-3)

[A research priority is to investigate] ecosystem vulnerability or resilience [to alien species' introduction]. (Genovesi & Shine, 2004, p. 18)

Restoration of native species and habitat conditions in ecosystems that have been invaded. (The White House, 1999, p. 6184)

Assessing these behaviors and impacts is a data-intensive affair. In the Dutch policy plan, to categorize species as invasive, data are needed about the mode of distribution and reproduction rates. In the European policy plan, data about specific trajectories or movement and distribution are needed. Finally, the USA policy plan requires ecological data to determine the damage to habitat conditions caused by species categorized as invasive, as well as to outline possible ways to restore them.

As in the construction of invasiveness in science, data about behavior are closely linked to the assessment of the impact of invasives. In fact, impact appears as the most important criterion in the construction of invasiveness in policy. The central tenet of all three documents is that the impact of invasives has to be minimized. Therefore, different kinds of data are needed to assess, reduce, and monitor this impact, such as data about socio-economics and ecology acquired by risk analyses in the corresponding fields of impact (society, economy, ecology). For example, in the European plan, the objective is *"to prevent or minimize adverse impacts of invasive alien species on Europe's biodiversity, as well as their consequences for the economy and human health and well-being"* (Genovesi & Shine, 2004, p. 13). In the U.S. plan, the aim is to prevent, control, or minimize the impact of (invasive) species, with explicit reference being made to the execution of risk assessments to support decision making (The White House, 1999). The Dutch

plan refers explicitly to the need to optimize decision making and argues that the control and management of invasive species should be based on the cost effectiveness of measures in preventing negative socio-economic impact:

> Not every exotic will be actively controlled. The decision to control an exotic depends on the nature and magnitude of the problem caused by the exotic species and the expected societal and financial efforts required for control. (Verburg, 2007, p. 2)

Such assessments include not only financial and economic considerations, but also societal ones. For example, the Reeves' muntjac (*Muntiacus reeves*) is categorized as invasive and is not actively controlled in the Netherlands despite its non-Dutch origin and rapid distribution. This is not only because of its impact – which is not considered to be very high – but also because control measures such as hunting are considered to be societally unacceptable (Verburg, 2007).

Our discussion of the three policy plans has demonstrated that the construction of invasiveness in policy focuses first of all on origin, referring in this case predominantly to policy spaces rather than ecological spaces. To assess the origin of species, data about their country of origin are needed to categorize species as native or non-native. Behavior seems to be less important, particularly when compared with the construction of invasiveness in science, but impact takes central stage in policy as the main criterion used to construct invasiveness. The impact assessment and subsequent decision making about control and eradication measures utilize different tools and procedures that require a wide variety of data about the ecological, societal, and economic impact of species.

2.5 The construction of invasiveness in wildlife management

To a certain extent, wildlife managers rely on the construction of invasiveness in science and policy and work with the categorizations of invasives offered in these domains. In practice however, the management of invasive species is also informed by the experiences and expertise of the managers, the specifics of the local context, and the human-wildlife interactions that take place in, and shape, wildlife management practices. The analysis in this section shows that origin and impact are important criteria in the construction of invasiveness in wildlife management. However, in contrast to science and policy, the invasives' behavior is the most important criterion as it forms the key locus of intervention and management. This section also makes clear that in wildlife management it is not necessarily only species that are classified as invasive, as in science and policy, but individual animals as well. Our analysis zooms in on two management plans for wild boar in the USA, one

in Tennessee (Great Smoky Mountains National Park) and the other in Oregon. In the former, they are commonly indicated as wild hogs and, in the latter, feral swine. In addition, we discuss the examples of the Yellowstone wolf in the USA and the brown bear in the Pyrenees. All these examples illustrate how invasiveness is constructed in wildlife management and what spaces and data are used in the categorization of invasives.

The wild boar management plan in the Great Smoky Mountains National Park gives the following description of wild boars:

> The wild hog [a derived meaning of wild boar] is an exotic species to Great Smoky Mountains National Park. National Park Service policy is that manipulation of populations of exotic plant and animal species, up to and including total eradication, will be undertaken whenever such species threaten the protection or interpretation of resources being preserved by the park. (Smoky Mountain Mall, 2012)

This quotation shows that invasives are categorized with a brief reference to their 'exotic' origin. However, as the second part of the quote demonstrates, their behavior and impact are the key criteria used to justify their removal from the national park. These criteria are extensively discussed in the following quote:

> Wild hogs wallow in wet, muddy areas to keep cool and rid themselves of parasites. Wallowing is detrimental to the soil and plant life in the vicinity. The hog behavior of rooting while searching for food causes the most damage to the park. Many plant species, including ones that are rare or that take several years to flower, are eaten, trampled, or uprooted by the rototiller action of a foraging hog. Native animals are also victim to the wild hog through direct consumption, destruction of habitat, and competition. For example, red-cheeked salamanders, which are endemic to the park, are commonly found in hog stomachs. Both wallowing and rooting contaminate streams, causing potential problems for the native brook trout. Hog occupied drainages have been found to have a higher concentration of coliform bacteria than unoccupied drainages. These bacteria contaminate water sources, which is a health consideration in heavily used recreational areas such as the park. (Smoky Mountain Mall, 2012)

Despite general references to wild boar as non-native and damaging, the actual management of wild boars depends on the location of individual animals. As the next quote demonstrates, wild boar present within national park boundaries are to be

removed and released outside national park boundaries; wild boar present outside national park boundaries are to be hunted:

> The park has found that a combination of trapping and direct reduction methods has proven to be the most successful in reducing the numbers of these non-native mammals. Since the invasion of the wild hog in the late 1940s, nearly 7,500 animals have been removed by trapping and/or shooting. Many of the hogs removed from the park are trapped and transported to wildlife management areas to be released for hunting purposes. (Smoky Mountain Mall, 2012)

This example makes clear that the design of management strategies for invasive wild boar is not based primarily on origin or impact, with associated references to space and uses of data, but on the location and behavior of individual animals. Spaces of occurrence, assessed by data on the exact location of the wild boars, within or outside national park borders, together with data about population sizes are used to make decisions about the trapping and hunting of animals.

The management of wild boar in Oregon (in this case indicated as feral swine) provides a similar example with a comparable reliance on the generation of data about the behavior of invasives. The Oregon Invasive Species Council (2013) placed feral swine on their 100 most dangerous invaders list because of their impact on ecosystem processes, their history of invasion around the world, and the risk of transmitting livestock pests. A risk analysis had concluded that the threat of destruction to natural habitat, agriculture, and livestock in Oregon was imminent without action (Rouhe & Sytsma, 2007). In response to these impact assessments, the management plan starts by emphasizing the non-native origin of the feral swine by discussing its Eurasian roots and its introduction by humans into the USA, and then continues to describe the behavior and impact of these animals in predominantly negative terms such as 'aggressive', 'rapid and large population expansion', 'free-ranging', 'areas disturbed by swine', 'transmit disease to humans' (Rouhe & Sytsma, 2007). The importance of managing wild boar in Oregon is underpinned by data about their impact on ecosystems, agriculture, and disease transmission. Moreover, the plan includes specific areas from which the feral swine are to be removed by means of hunting (ground hunting with dogs and aerial hunting) and trapping – the so-called feral swine eradication areas – and areas in which they are tolerated. These spaces are established on the basis of the location and behavior of the species, from data about their home range, seasonal movements, food abundance, and population sizes. In addition, socio-economic data concerning the impact of the species are used.

However, establishing and maintaining these zero-tolerance and wild-boar-tolerant spaces is complicated because of the behavior of the animals, which move around and can easily cross the boundaries between the areas. Additionally, the establishment of an eradication area requires several months. Together with the fact that boars can be very active and can have large home ranges under conditions of scarcity[2], the hunting of wild boars often lags behind their actual presence. Consequently, management interventions are required that focus generally on controlling the feral swine's population size to ensure their containment in the wild-boar-tolerant areas, and on enhancing the effectiveness of their eradication from the zero-tolerant areas. Doing so requires detailed data about the locations, numbers, and movements of wild boars. To ensure that all management's data needs are met, the plan proposes a database that includes entries for signs of wild boar disturbance, the costs associated with wild boar disturbance, wild boar sightings, the numbers of wild boars sighted, the likely populations to which these sighted boars belong and their sizes, the number of boars removed (hunted, trapped), and any actions taken by citizens or government officials dealing with wild boar (Rouhe & Sytsma, 2007). Again highlighting the importance of data in wildlife management practices, the plan stipulates that the proposed database should be updated regularly, since wild boar populations change, and maps and data can quickly become outdated. As in the former example, data about the location and behavior of individual animals are important in the management of invasive wild boars.

In Yellowstone, the wolf was reintroduced in 1995. Instead of waiting until the wolf eventually re-established itself in the area, which it had a high likelihood of doing according to some experts (Fritts et al., 1997), it was decided to actively reintroduce the wolf so that it could be categorized as an 'experimental, non-essential' population. This was attractive because it implied that the government could deal with so-called problem wolves, for example by hunting or relocating them. Since then, the management of the Yellowstone wolves has focused on the conservation of elk, which is a prey species, and wolves, as well as on the prevention of negative human-wolf encounters (Garrott et al., 2005). To make this possible, specific ecological data are needed to assess the effects of wolf predation on the elk population (Garrott et al., 2005), and data are also required to reduce or minimize socio-economic impacts such as human safety and the killing of pets and domestic livestock.

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[2] Under scarce food conditions, boars travel at >0.4 km/h and have an expanded home range that they transverse daily. Under abundant food conditions, boars travel up to 0.1 km/h.

Management practices vary with the seasons, especially on the northern Yellowstone range because of the high densities of elk and other ungulates during winter. At that time, hunting pressure is high, resulting in both wolves and humans having to 'compete over prey' (Smith et al., 2003). Management is particularly necessary in light of the local concerns that have emerged in response to the reintroduction of the wolf. Farmers in the surroundings of Yellowstone argue that the wolf is invasive because it is non-native to the area, and that it ought to be shot because it was transported from Canada. The tourism industry on the other hand emphasizes the nativeness of the wolf as an integral part of the Yellowstone ecosystem, which should be protected. This example makes clear that the occurrence and the kind of impact that Yellowstone wolves cause (ecological, societal, economic) determine whether they are categorized as invasives and how they should be managed. Moreover, managing Yellowstone wolves requires detailed data about their abundance, (seasonal) movements, occurrences, and their effects in the Yellowstone area to decide to either control the population or deal with individual problem wolves.

In France, the reintroduction of the brown bear is also highly contested, specifically in the Pyrenees. In the 1930s, around 200 bears were living in the Pyrenees, but, by the mid-1990s, only five remained (Chapron et al., 2009). To stimulate population recovery, three brown bears from Slovenia were introduced into the area. The five 'original' Pyrenean brown bears became extinct, and currently around 20 – Slovenian – brown bears are living in the area. The reintroduction of brown bears is propagated by conservation groups as well as ecologists, motivated primarily by the disappearance of the brown bear from the rest of France. These advocates have continually come up against opposition from shepherds, hunters, farmers, and other local mountain people who claim that the Slovenian bears kill their cattle and fear that the bears will attack humans and invade human territory (Lusher, 2000). The advocates dismiss the fear of cattle killings by arguing that, of the annual six percent of sheep deaths (for example by falling, sickness, predation by several animals, or undercooling), only one percent is due to the brown bear (VPRO, 2010). To manage the brown bear, ecological data about the behavior and impact of the Pyrenean population is needed (demography, population viability, predation, and ecosystem effects). However, these data alone will not suffice, and inhabitants will only accept the reintroduction if they are convinced that cohabiting with bears is possible (Chapron et al., 2003). This is not the case in the Pyrenees. As a local farmer of 200 sheep (Smith, 2009) stated: *"I love bears, but I don't want to have to live with them"*, and another added *"It's changing our way of life, our way of farming"*. Because of this negative attitude, detailed management of the relations

and interactions between bears and inhabitants became a necessity. Additional ecological data about the bears' behavior was needed: the bears are tracked by means of radio collars and transceivers as well as by bait at observation posts, and local decision makers and inhabitants are regularly updated about their individual behavior and impact. Moreover, the social acceptance of the bears, specifically those of Slovenian origin, was promoted by setting up specific working groups (Decaluwe & Quenette, 2009). Thus, detailed ecological data about the individual behavior of the brown bear were collected and used to design strategies to minimize their impact and human-bear contact.

As these four examples make clear, the categorization of species and individual animals as invasive and their subsequent management are generally informed and justified by assessments of their non-native origin and negative impact. The wild boar in Oregon and Tennessee in the USA are categorized as non-native because of their Eurasian origin; the Yellowstone wolves are categorized as non-native because they were introduced from Canada, and the brown bears in the Pyrenees are categorized as non-native because they were introduced from Slovenia. The ecological and socio-economic impact of these invasives is assessed using ecological and socio-economic data about damage as well as data about public attitudes toward these species and individual animals. Apart from these inputs regarding origin and impact, this section has demonstrated that the actual management of invasives is predominantly shaped by assessments of their behavior. Space is very important in these assessments, not in order to demarcate native from non-native species as in science and policy, but to demarcate spaces with different management regimes (tolerance, control, removal, hunting). Moreover, these wildlife management spaces have rather flexible boundaries as wildlife management practices change in response to changes in the behavior of invasives, as in the Oregon case. These wildlife management practices require detailed data, not in order to once and for all 'prove' the invasive character of species, but to enable detailed surveillance of the movements and numbers of animals.

2.6 Spaces, data, and the categorization of invasives in science, policy, and wildlife management

Our analysis reveals some important differences in the construction of invasiveness in science, policy, and wildlife management. Broadly speaking, the main focus in the construction of invasiveness is, successively, in science on the origin of the species, in policy on the impact of the species, and in wildlife management on the behavior of the species. Thus, these domains categorize invasives differently, on the

basis of different kinds of spaces and different types of data. We start by juxtaposing science and policy and then move to wildlife management.

In science and policy, assessments of origin differ with respect to the kinds of spaces referred to. In science, ecological spaces such as ecosystems or habitats, demarcated on the basis of ecological or geographical data, are used to demarcate native from non-native spaces. In contrast, policy uses policy spaces such as countries, states, and conservation areas. As a result, data requirements differ as well. Whereas for policymaking data about the country of origin suffices, science requires detailed data not just to determine the original occurrence of species but also to decide what spaces are to be considered as native or as non-native. To assess species' behavior and impact, data requirements also differ between science and policy. Science tends to focus on data about the ecology of species, including colonization or reproduction rates. Apart from a general agreement that invasive species can cause damage, there is no consensus about the use of impact as a criterion because that would imply judgments about impact thresholds, which are considered problematic from a scientific point of view. In contrast, policy does require detailed information about the extent of ecological, societal, and economic damage in order to prioritize and make decisions about control and eradication measures.

In relation to wildlife management, constructions of invasiveness appear less concerned with the origin of invasives or even with the extent of damage they cause, although these do play a role in justifying the need for management. Instead, the construction of invasiveness in wildlife management focuses predominantly on the behavior of species, and particularly individual animals. This focus on behavior comes with different spaces and different data needs. Instead of demarcating native and non-native spaces, wildlife management practices demarcate spaces with different management regimes. These management regimes require different kinds of data than those identified in science and policy. Particularly, the use of data is less about deciding what species are to be categorized as invasive and subject to control policies, as in science and policy, and more about the continuous surveillance and monitoring of the occurrences, numbers, actions, and movements of individual animals or groups of animals in order to decide for example where to set traps or which to hunt.

The differences outlined so far demonstrate the multidimensional character of invasiveness and the multiple considerations that go into the construction of invasiveness. The connections between the construction of invasiveness and ideas about how invasives are to be treated as identified in our analysis usefully illustrate how the classification of nature is not a neutral activity but comes with normative

and prescriptive assumptions (Bowker & Star, 2000; Waterton, 2002). Finally, our analysis of the management of invasives demonstrates the dynamics involved in the classification of nature and their contingent character (Jones, 2009; Latour, 1999; O'Rourke et al., 2012; Soini & Aakkula, 2007). Specifically, our analysis points to three important characteristics of the construction of invasiveness in management practices. First, in contrast to the domains of science and policy where the construction of invasiveness is a rather distant affair that has to do with categorizing species as either invasive or not, management practices focus on individual animals and groups of animals. Second, and related to the first point, the categorization of invasives requires detailed and continuous data about the location, movements, actions, and numbers of individual animals. These data are both (ecological) scientific to assess the native or non-native origin of species, and ecological, societal, and economic to assess their negative impact. Third, spaces in wildlife management reflect different management regimes (tolerance, control, removal, hunting) tailored in response to the invasives' behavior. In contrast, predetermined ecological or policy spaces have rather rigid boundaries determined by science and policy. In other words, the construction of invasiveness in management is a contingent practice in which human-animal interactions take center stage (Hinchliffe, 2007; Hinchliffe et al., 2005; Ingold, 2005; Turnhout et al., 2013). As demonstrated in section 'The construction of invasiveness in wildlife management', the construction of invasiveness in management involves numerous encounters between animals and humans, for example when they are counted, when they are observed in a zero-tolerance space, when they are hunted or trapped, when they cause damage in urban areas, when humans perceive them as pests or rather harmless, and so on. It is these human-animal interactions that inform and constitute the actual management of invasives.

Concluding, we argue that the current preoccupations in scientific and policy debates about invasiveness with finding the correct definition of invasiveness and with collecting data to decide the origin or nativeness of species and their possible impact do not match well with the needs of wildlife management. To resolve these mismatches, we contend that it is important to more fully address the question, in science as well as in policy, of how humans and animals cohabit and live together in practice. Specifically, knowledge production and policymaking processes have to be committed to creating a fuller understanding of the multiple data as well as the multiple conceptions of space that go into the construction of invasiveness. The management of invasives cannot be an ecological affair only, but also has to include the dynamic and situated interactions between humans and (individual) animals.

Chapter 3

Common sensing:
Human-black bear cohabitation practices in Colorado

Abstract

Current wildlife management practices in western societies must increasingly deal with human-wildlife conflicts. In their attempt to spatially regulate humans and wild animals, the common focus is on containment, endeavoring to facilitate the removal and exclusion of wild animals. Recently, however, ideas of cohabitation have emerged in wildlife management practices, suggesting that humans and wild animals share the same space. We argue that aiming at cohabitation requires that wildlife management be approached as an interactive and dynamic endeavor involving humans, wild animals and landscape. Accordingly, wildlife management should no longer focus on the sole agency of humans; it must also examine the agency of animals and the influence of the landscape in which the interactions takes place. To understand these interactions and dynamics we introduce the concept of multi-sensory writing and reading and apply this to an in-depth study of black bear management on the Colorado Front Range, U.S.A. We analyze our results focusing on the spatial interactions between human, black bear and landscape. We conclude suggesting that cohabitation as a goal of wildlife management requires a radical decentralization and spatialization where humans, wild animals, and the landscape shape interactions co-creatively.

Common sensing: Human-black bear cohabitation practices in Colorado

3.1 Introduction

As human populations continue to expand and wildlife habitats continue to shrink, conflicts between humans and wild[1] animals are multiplying worldwide (Carter et al., 2012; Knight, 2000b; WWF, 2006; Yeo & Neo, 2010). Humans and wild animals increasingly invade each other's spaces in their search for – limited – resources (e.g. food and shelter). This can result in dangerous and harmful situations in which wild animals come (too) close to humans thereby posing a threat or causing damage, or, vice versa, in which humans come (too) close to wild animals, thereby destroying habitats and threatening species survival. To overcome human-wildlife conflicts, conservation practices have to anticipate and address these situations. Until recently, the main focus has been on excluding wild animals from human environments in so far as possible (Wolch & Emel, 1998). Related to this need to spatially separate humans and wild animals, a dichotomous (human versus wild animal) and anthropocentric approach to conservation has become dominant (Ingold, 1994; Jepson et al., 2011; Knight, 2000b; Robbins & Moore, 2013).

The concept of cohabitation, or coexistence by humans and wild animals, has been proposed as a critique of and alternative to this dichotomous and anthropocentric approach. The central idea of cohabitation is that humans and wild animals should (peacefully) share the same space (Hinchliffe, 2007). Wild animals are then accepted as 'fellow inhabitants' that actively co-shape the space in which humans and wild animals can dwell, rather than being relegated to the role of 'other entities' to be acted upon by humans. From this perspective, resolving human-wildlife conflicts implies mutual adjustment by both humans and wild animals as they learn to live together. Such thinking in terms of mutual adjustment has resulted in a focus on relationships between humans and animals and the acknowledgment of animal agency in these.

Neo and Ngiam (2014), for example, touch upon animal agency in their debate on in situ or ex situ conservation of dolphins. In the dolphins' relations with human trainers, they both invent new behaviors and learn behaviors cued by the

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[1] We use the term wild to make a clear distinction between wild versus domesticated animals, since our focus is mainly applicable to non-domesticated (excluding husbandry and pets). By using the terms humans versus animals, we do not imply that humans are not animals, but we reserve the term animal for nonhuman animals.

trainer. These behaviors, the researchers argue, are not entirely the result of the will of the humans, nor entirely of the will of the dolphins. Rather, humans and dolphins learn to accommodate each other. They argue that dolphins can be seen as active participants (agents) based on their 'dolphin-ness'. Similarly, Keul (2013) examined human-alligator relationships in tourism in the swamps of Louisiana and states that embodied encounters between humans and gators create learning opportunities for both. Keul shows how the gators are more than just bodies; they are 'sentient negotiators of space', in the sense that they may or may not show up at a tour or perform as expected by humans.

Traces of a relational approach are already visible in conservation practices dealing with human-wildlife conflicts, for example in education programs that focus on the human acceptance of the presence of wild animals and try to teach humans what they can do to prevent wild animals entering human properties (Baruch-Mordo et al., 2009, 2011; Thompson, 2002; Yeo & Neo, 2010). Such approaches argue that wildlife managers need to 'think like' the 'problem animal' in order to successfully track the animal and subsequently apply appropriate strategies to ease the conflict (Hurn, 2012). Nonetheless, such programs are scarce and exist alongside traditional forms of management, including, for example, the removal of animals from human populated areas. Yeo and Neo (2010) express their dissatisfaction with these kinds of wildlife practices arguing that in human-monkey conflicts in urban Singapore *"solutions remain highly arbitrary [. . .] as human interests still overshadow animal welfare"* (p. 697). While Keul (2013) argues that a recognition of human-animal relationships and animal agency is required to further cohabitation, these papers suggest that a dichotomous and anthropocentric approach still dominates conservation practices (Barua, 2014a, 2014c; Jepson et al., 2011; Lorimer, 2010a, 2010b). Cohabitation as the result of humans and wild animals merely living alongside each other doesn't acknowledge the idea of *co*-shaping or *co*-producing the space in which both dwell, and the question of how to give (wild) animals a more prominent role with respect to cohabitation has not yet been resolved (Buller, 2014; Urbanik, 2012).

Existing studies in what has been dubbed as 'the animal turn' in social science research have addressed this question (Bear & Eden, 2011; Buller, 2014; Hinchliffe et al., 2005; Hobson, 2007; Lorimer, 2006a; Lulka, 2004, 2009). Their work suggests to us that one way of moving towards the co-production of landscapes and understanding and resolving human-wildlife conflicts require the exploration of the spatial *interactions* between humans and animals by zooming in both on the attribution of agency to wild animals, and examining the consequences of doing so for conservation practices. As a result, grounded and in-depth explorations of the

manifold human–non-human relations are necessary (Urbanik, 2012). Gooch (2008), for example, describes the shared world of the Van Guijars and their buffalos on their yearly walk through the Himalayas and shows how the Van Guijars' pastoral practices are constantly adapted to the needs of the buffalo. Bear and Eden (2011) conclude in their article on angling practices that encounters between anglers and fish differ according to the various (aggregations of and individual) fish engaged. Hinchliffe et al. (2005) discuss the dynamics of tracing water voles and illustrates how the humans, water voles and sites under investigation coevolve in this process.

In this chapter, we contribute to the above described in-depth explorations of human-wild animal-landscape interactions by examining both direct and indirect encounters between (individual) humans and (individual) wild animals in human-wildlife conflicts regarding black bears in Colorado. The wildlife management practices that we describe involve black bears, wildlife managers, policymakers, local residents, wildlife researchers, and the spatial interactions between these actors. Importantly, we do not merely focus on humans following animals or humans understanding wild animals (e.g. Bear & Eden, 2011; Hinchliffe et al., 2005; Lorimer, 2006a). Rather, it is our intention to emphasize the role of the wild animal as a co-constitutive participant in cohabitation practices and to highlight the spatiality of the interactions between humans and wild animals by exploring how these (ongoing, back and forth) interactions shape the landscape in which they are situated.

To explore the meanings and practices of cohabitation from a decentralized and symmetrical perspective and to replace the prevalent dualistic-anthropocentric approach to wildlife management with a more nuanced appreciation of the joint nature of cohabitation[2], we introduce a lens of *multi-sensory writing and reading by both human and wild animal*. In doing so, we draw on and extend Hinchliffe et al.'s (2005) notion of 'water vole writing'. They use this notion to refer to the traces that animals leave and the way humans use those traces to investigate these animals' dwellings and movements. In our analysis, we focus on similar processes of writing (leaving marks using a variety of signs), but we complement this with a focus on reading (tracing and interpreting the writing through all senses). Also, we add symmetry by investigating writing and reading processes as they are being done by both human and wild animal and consider how these – interactive and dynamic – processes contribute to our understanding of the coproduction of landscapes with respect to cohabitation. The methodological originality of this chapter lies in its focus

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[2] We don't claim an 'equal' cohabitation here, meaning humans are equal to animals. We acknowledge differences, such as intelligence. We are not advocating civil rights for animals in this chapter.

on the multi-sensory aspects of human-wild animal interactions, in terms of their materiality, their function as a guide to behavior, and their general impact on the lifeworlds of both human and wild animal. In other words, human-wild animal interactions are a matter of 'common sensing' where both humans and animals leave their traces and interpret them through their senses. This methodology bears a resemblance to what others have termed 'bio-geo-graphies' (Barua, 2014a; Lorimer, 2010a), trans- or multi-species ethnologies (Hurn, 2012), and ethnoelephantology (Locke, 2013), combining ethnographic with ecological/ethological records (Bear, 2011; Hodgetts & Lorimer, 2015).

Before presenting our findings, we first discuss the animal turn in sociology, zooming in on the idea of cohabitation. We proceed by outlining our perspective of multi-sensory writing and reading and detailing our methodological and analytical strategy. We then describe our findings concerning black bear management on the Colorado Front Range of the Rocky Mountains and discuss them in light of recent literature on human-wildlife interactions and their management. We conclude our chapter by suggesting that cohabitation requires the radical decentralization and spatialization of wildlife management in which the interactions between humans and animals, and the landscapes that shape these interactions, become the primary focus of management interventions. To facilitate cohabitation, common sensing – humans and animals communicating through their reciprocal use of multiple senses – should become common practice in wildlife management.

3.2 Cohabitation and the animal turn

The special issue 'Bringing the animal back in' (Wolch & Emel, 1995) (re-)opened scientific debate to re-animate[3] social theory (Emel & Wolch, 1998; Feinberg et al., 2013; Ingold, 2005; Philo & Wilbert, 2000; Wolch & Emel, 1995). Since then, various scholars have contributed to this debate, resulting in the generation of a variety of conceptions and ideas such as zoöpolis (Donaldson & Kymlicka, 2011; Wolch, 1998), multi-species networks (Latour, 2004b), dwelling geographies (Ingold, 2005; Johnston, 2008), lively bio-geo-graphies (Barua, 2014a; Lorimer, 2010a, b) and multi-species social practices (Buller, 2014). These conceptions have in common that they touch upon the entanglement of human and animal lifeworlds (Hinchliffe & Whatmore, 2006; Latimer & Miele, 2013; Locke, 2013) and the places where humans and animals 'belong' (Schneider, 2013). In this chapter, we use the concept of cohabitation (Barua, 2014c; Bear & Eden, 2008; Hinchliffe et al., 2005;

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[3] By using the term animate we refer to the debate to give animals a more prominent place in social theory. We don't refer to or elaborate on linguistic debates concerning grammatical distinctions between animate and inanimate.

Lulka, 2004, 2009) to highlight the spatial interactions between humans and wild animals as well as the spaces (landscape in its broadest sense, including human-modified and naturally occurring spaces) that shape and are shaped by these interactions (Hinchliffe & Whatmore, 2006). Cohabitation in this sense involves space-shaping activities by both humans and wild animals resulting in the co-production of landscapes. This implies that the respective wild animals should be engaged with as creatures with an agency of their own that can influence conservation strategies. Accordingly, cohabitation results in a constant rearrangement of our relationships with wild animals (Dempsey, 2010; Jepson et al., 2011).

This concept of cohabitation goes a long way towards replacing problematic categories and terms in wildlife management – among which the concept of management itself – that rely on generic scientific representations of wild animals and their behavior. This is important since the continued use of these categories and terms serve only to reinforce traditional management practices that are based on the attribution of otherness and the organization of space to legitimize control and separation (Cassidy & Mills, 2012; Hinchliffe & Whatmore, 2006; Lulka, 2004). Particularly in solving and anticipating human-wildlife conflicts, the need to develop management strategies is inherently policy-driven and anthropocentric. Conversely, the idea of cohabitation allows a more dynamic appreciation of differences, e.g. between different spaces and between individual humans and individual wild animals (Bear, 2011; Dempsey, 2010; Hinchliffe et al., 2005; Lorimer, 2008b). As Barua (2014a) states: *"not all animals are alike, for they have different ethologies and personalities that influence the ways in which cohabitation is perceived and performed"* (p. 928). It is through the dynamic process of cohabitation that the involved animals come to be seen as fellow subjects rather than pre-formed objects (Hinchliffe et al., 2005).

We contribute to the ongoing discussions about cohabitation by highlighting the spatial dynamics that take place between humans and wild animals. As we explained earlier, humans and animals do not just interact with each other, they also interact with the landscape. This might, for example, be with regard to the availability of food sources or to the creation or removal of physical barriers that attract or repel humans or wild animals. These entanglements of human, wild animal and landscape are described by Hayden Lorimer (2006a) as 'earthy and worldly relations' that are drawn together through their prolonged shared experiences. Lorimer (2006a) argues that to understand the 'lifeworlds of landscapes' (where human and nonhuman are 'lively, willful and sensible agents'), it is necessary to follow the movements and actions of humans and wild animals. These movements

and actions compose 'microgeographies of worldliness'. In our case we might talk about the creation of 'microgeographies of cohabitation', created by the space-shaping activities of humans and wild animals. To understand these space-shaping activities, it is important to consider the individual and shared experiences of both humans and wild animals (Ingold, 2000; Lorimer, 2006a). Building on Ingold's (2000) observations, we note that both humans and wild animals undergo developments in a wider field of relationships: between humans, between animals, between humans and animals as well as with the landscape in which both dwell. For example, Herrero (2002) argues that an individual bear's behavior may reflect the outcomes of past confrontations with humans or other bears. And Barua (2014a) describes how human and elephant bodies coproduce the landscape, based on the continual unfolding of their life activities and their movements through the landscape. Thus, both humans and wild animals are active and creative producers of landscapes of cohabitation.

To further our understanding of the space-shaping activities of humans and wild animals, we need to think through the use of the senses (visual, olfactory, auditory and tactile). Ingold (2000) states that vision[4] dominates Western societies. However, using sight to understand human-wildlife conflicts is problematic. One problem is that many animals are better informed by other senses than sight. Dogs and bears, for example, have an acute sense of smell. As Herrero (2002) explains: *"it is futile to try to hide a candy bar by putting it under a camp pillow. You may escape the eye [. . .] but not the nose of bear"* (p. 137). Another problem is that generally speaking, humans and non-human animals are simultaneously informed by multiple senses (Carolan, 2011; Ingold, 2000). To further our understanding of cohabitation practices and the interactions and dynamics between humans, wild animals and landscapes they entail, we propose the concept of multi-sensory writing and reading.

3.3 Multi-sensory writing and reading

The concept of multi-sensory writing and reading draws on what Deleuze and Guattari call 'the material processes of writing' (Deleuze & Guattari, 1988). Signs (visual, olfactory, auditory, tactile), materialized in words, signals or things, are communicated between humans, between wild animals and between humans and

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[4] Marvin (2005) discusses different forms or intensities of viewing animals, that shifts from passive to active viewing. The way animals are looked at is fundamental to how the animals are responded to and impacts the relationships between humans and animals. In this chapter it is not our aim to unravel these different views from a human perspective, but to emphasize vision as one of the existing senses for human and animal.

wild animals through the writing and reading of these signs in the landscape. The communicative repertoire used by humans and animals may differ, and individual humans and individual animals may or may not understand the transmitted signs and subsequently may or may not respond to them. Communication with wild animals is apparent in most traditional hunter-gatherer practices where the human hunter needs to 'think like' his or her quarry to track it (Hurn, 2012). This requires years of experience in which the animals are recognized as independent actors. Interpreting each other's writing and reading and the actions based on those interpretations can have meaningful consequences, such as, for example, in those hunter-gatherer practices resulting in an (un)successful hunt (Hurn, 2012). The communication through signs between human and wild animal, however, only takes into account the (limited) material aspects of the human's or animal's communication. Only these material aspects either can access and interpret. This implies that a considerable portion of the human's or the animal's lifeworld can't be accessed. But, as we acknowledge, other aspects of their lifeworlds, such as shared experiences, and the abilities, achievements and consciousness of animals are both 'hidden and expressed' in these material aspects (Barua, 2014b; Gooch, 2008; Hurn, 2012; Ingold, 2000; Lorimer, 2006a). Detailed observation, particularly when combined with prior experience can reveal hidden messages (Gooch, 2008; Marvin, 2005). For instance, Herrero (2002), describes the process of a researcher tracking the route taken by a radio-collared male black bear on foot. While he was following the bear, it seemed to the researcher that the bear intended to throw off his follower because the tracks he left changed in terms of how difficult they were to distinguish and interpret, going from muddy tracks to walking from rock to rock and finally even backtracking in his own tracks. Although only the material aspects (the tracks) were observed, the route taken (e.g. through deep parts of streams possibly to cool off) and the increase in complexity of the tracks, revealed something of the lifeworld of the black bear.

The importance of senses other than the visual in the material process of writing is further explicated by Thrift (in Merriman et al., 2012) in his notion of three-dimensional writing. While Thrift ascribes this writing to humans, Hinchliffe et al. (2005) has extended it to wild animals, in his case water voles, and refers to it as *"the footprints and other marks that water voles leave or make as they go about their business"* (p. 647). In other words, water vole writing refers to the writing done by water voles and the subsequent reading of those signs by humans. However, the reverse process – how water voles read and respond to the traces left by humans – is not addressed. In other words, the joint space-shaping activities of humans *and* water voles are not made explicit.

Our notion of multi-sensory writing and reading recognizes that both humans and animals leave traces as well as trace, interpret and respond to these traces. Human writing in our case refers not only to the use of words, such as in policy and management plans that describe how to deal with human-wild animal interactions, but also to communication without words, such as in placing fences to physically demarcate human from nonhuman spaces. Animal reading refers to the interpretation and enactment of these human writings as they become observable in the changing behavior and movements of the animals. The responses by animals are communicated through signals or things – animal writing –, such as footprints, left fur, faeces, and scent markings that indicate their presence in an area or demarcate their territories. Besides material traces and signs by humans and animals, we also recognize the role of 'intermediary devices', or 'connecting links', mediating in human-animal relationships. Awareness of such devices contributes to our aim to make processes of human and wild animal writing and reading explicit, especially with regard to their space-shaping activities. Barua (2014c), for example, explains the (surprising) binding role of alcohol in an ongoing human-elephant conflict in India: humans drink alcohol to stay awake to guard wild elephants and prevent crop raiding, while these elephants are attracted to the villages by the aroma of alcohol. Alcohol thus importantly affects what the elephants do. Similarly, Marvin (2001) describes the role of foxhounds that are particularly bred to have the 'nose' (the ability of these hounds to follow the 'fox-smell'), 'voice' (the ability to communicate with the hunters when they find a fox-track) and 'fox sense' to hunt foxes. These hounds then, act as an extension of humans' limited sensory capabilities. Both alcohol and foxhounds can be seen as important 'intermediary devices' contributing to an understanding of both human and animal space-shaping activities.

Thus, the concept of multi-sensory writing and reading stresses not only the use of all senses, but also the continuous process of on-going interpretations by both human and wild animal, the continuous rearrangements of our relationships with wild animals, and the possible mediation of 'intermediary devices', in close connection with the landscape in which both dwell. However, the concept of animal reading and, to a certain extent also their space-shaping activities, are not – as yet – made explicit in research or practice. The following research questions thus guided our research: How can we understand the interactive and dynamic processes between human, wild animal and landscape through processes of multi-sensory writing and reading?; How does a focus on this human and wild animal multi-sensory writing and reading help in constructing strategies and tools of cohabitation?

The specific case study on human-black bear management that is narrated in this chapter was carried out in the summer of 2012 during a two-month stay by the

first author on the Colorado Front Range of the Rocky Mountains in Colorado, USA. We focused on three different locations on the Colorado Front Range (north-east, east, south) in order to cover spatially different habitat types where interactions between humans and black bears occur and, arguably, need to be managed. The first author carried out a total of 37 in-depth interviews with wildlife researchers, wildlife policymakers, wildlife managers and local permanent residents, three focus groups with local permanent residents, and five days of participant-observations with wildlife managers in the field. In the in-depth interviews the emphasis was on understanding human-black bear management in detail as seen from the differing perspectives of the interviewees, including their interactions with black bears (as a species and as individuals), as well as with other humans, and their experiences (with living) in bear country. Recent examples of management interventions were explored. A similar strategy was used in the focus groups with local residents where the emphasis was on the collection of local stories concerning human-black bear management. All interviews and focus group discussions were tape-recorded and transcribed ad verbatim. As part of the participant-observations, the first author accompanied wildlife managers in the field on their daily practices, observed actual occurrences of human-black bear interactions and subsequently employed management strategies, and she gained insight into their experiences with black bears in the particular regions, by conducting informal ethnographic interviews (Delamont, 2010; Soss, 2006). These interviews were partially tape-recorded and partially recorded in detailed field notes. Additional – incidental – visits in the areas with local residents, such as attending a meeting of a local volunteer group involved in black bear issues, were also recorded in field notes. Finally, our study also draws on textual analysis of key scientific, policy, and educational documents on human-black bear management, black bear ecology, and recent studies of tracking black bears in this region.

Our intention was to construct a picture of the 'lived experiences' of humans and black bears in proximity to each other, i.e., their experiences of 'living together', on the Colorado Front Range (Bear, 2011; Dempsey, 2010; Hodgetts & Lorimer, 2015). To that end we first analyzed the transcripts and records focusing specifically on the actions of humans and black bears (Law & Mol, 2008). Here the focus was on 'key incidents' to reveal the detailed interactions between humans and black bears (Emerson, 2010). We concentrated on the different ways in which humans and black bears responded to each other's presence, the actions of each, the processes of mutual decision making (Buller, 2015), and the subsequent implementation of management strategies on the part of the wildlife manager. Second, we correlated the described processes with available scientific knowledge about black bears in general as well as

with other available accounts of prolonged human experiences with black bears in the respective regions. Thirdly, we focused on the landscapes involved in relation to the actions of humans and black bears in order to address their various relations, spaces and space-shaping activities (Barua, 2014c; Buller, 2015; Law & Mol, 2008; Locke, 2013). This provided the basis for our analysis of the meanings and practices of cohabitation, multisensory writing and reading, and the interactive and dynamic processes between human, wild animal and the landscape.

For reasons of anonymity we chose five fictive characters that represent the principal human group of actors involved in human-black bear management on the Front Range: John, the wildlife manager in the field; Emma, the researcher; Gary, the policymaker; Sarah, the local resident; and Will, the volunteer. Names and genders are arbitrarily chosen and the actual person that this name represents is not necessarily of the same person and gender throughout the text. For clarity in writing we sometimes add additional 'voices', for instance by adding a colleague of John's. When we write about individual black bears, they are usually referred to as '(s)he' when gender is not known and 'he' or 'she' when gender is known.

3.4 Human-black bear interactions on the Colorado Front Range

Our study is situated on the Colorado Front Range of the Rocky Mountains where the human population has more than doubled since 1960, and is currently about 4.1 million people. This is also reflected in the number of (sub)urban areas, which has more than tripled state-wide (Center of the American West, 2001; Colorado State Demography Office, 2014). Although the exact number and trend of black bears inhabiting the Front Range and Colorado at large is unknown (Baruch-Mordo, 2007), wildlife researchers and wildlife managers estimate that the total number inhabiting this area has been increasing, from 8,000 to 12,000 in the 1990s to an estimated 16,000-18,000 in 2012. The increase suggests that interactions between humans and black bears on the Front Range are increasingly likely to occur (Vieira, 2011). These interactions are most likely to occur in the period from May to November when black bears are actively fattening before hibernation and the availability of nutrition largely determines where they will be. This means that the spatial attributes of the landscape (such as the distribution of natural food sources) strongly affects the spatiality of both humans and black bears. In the aim for cohabitation, wildlife management in its broadest sense, which includes managers, policymakers, local residents and researchers, has an (political) obligation to manage spatial interactions on the Colorado Front Range in such a way as to achieve this goal. We begin by presenting the spatial interactions confronting wildlife management and showing how wildlife management responds to them. We also describe the role black bears play in these

interactions and management strategies. We do this by exploring the use of multi-sensory writing and reading by human and black bear and observing which management strategies are chosen in response.

We begin at a mid-sized town (between 100,000 and 200,000 human inhabitants) located on the Front Range. It is early morning on trash collection day, summer 2012. John and I (first author) wander around a neighborhood located close to a nature area. We walk through an alley full of trash cans, ready to be picked up and emptied by trash hauling services. However, besides neatly arranged, upright standing green and brown-colored trash cans of about 1.3 m in height, there are some lying on the ground, with the lid open and trash scattered all around. *"That is the job of a bear"*, John explains. He regularly checks this neighborhood for 'bear proof'[5] trash storage by local residents. Sarah, a resident, confirms that a black bear had been passing by that night, as she woke up after hearing the loud noise of the tipped over trash can. Here John and Sarah identify black bear writing; they read the combination of signs and relate them to prior experiences: a tipped over – non-bear proof – trash can, scattered trash and the loud noise of a pulled over – fully loaded – trash can. We discover more black bear writing further on in the alley where John points to some paw scratches on a shed. John explains that some nights ago, a black bear had successfully gotten inside that shed where the owner stored his trash and the black bear had been rewarded with food, all kinds of left overs, such as meat, fruits, vegetables, pie, macaroni and other high calorie food. The next day the owner locked the shed and a black bear – according to John most likely the same one that broke into the shed – had tried to get in and had left some paw scratches. However, this time, the bear wasn't rewarded with food. John said it is likely that (s)he continued searching the area for other easily accessible food sources, found the – unlocked, possibly overloaded – trash can of last night because (s)he was attracted by the smell of food inside it, and tipped it over. Here, multi-sensory writing and reading can be seen by the response of the owner of the shed. After reading the mess the black bear had left, the owner used a lock as a visual sign to the bear to stay away from the trash stored inside. Although the bear couldn't get at the trash when (s)he returned, the lock didn't prevent the shed being damaged by paw scratches. Many wildlife managers in the field and wildlife biologists state that a bear's single most powerful sense is his nose (Baldwin & Bender, 2010; Masterson, 2006). In this case too, it was rather the smell of the trash inside the shed that attracted the bear than that the shed was unlocked, as John explained. The owner used only a visual sign, namely a lock,

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[5] Meaning storing trash in such a way that black bears are not able to feed on the trash, e.g. through special locking systems for trash cans, storing trash in a shed or garage or freeze it to reduce smell.

to keep the bear away and not a scent sign. Consequently, the bear may still have been attracted by the presence of trash odors, although the shed might have been empty of trash the second time. In this instance trash can be seen as an 'intermediary device'. Trash in urban environments is connecting humans and black bears. Recent research (Lewis et al., 2015) indicated that black bears display 'garbage foraging' behavior, especially in poor natural food years and near nature areas, such as in this mid-sized town. And it demonstrated that, even when trash is properly secured, it may still be accessible if the storage is not robust 'enough' because black bears are very determined to get at it.

How humans can communicate with black bears using scent signals and how that affects the interaction between human and black bear, is illustrated by the following story, told by Will, a local 'Bear Aware' volunteer (neighbors educating neighbors). He describes two black bears that broke into a garage and what he and the owner did to keep them out the third time:

> *"And I got a call from her [a local resident] one morning and she said 'I made a terrible mistake, I never leave my garage door open, but this morning I was just getting to the Safeway [supermarket] real quick and right back and', she said, 'when I got back I had a mom [black bear] and a cub in my freezer in the garage'."* [. . .] Will explained that she had wedding cakes, shrimps, and all this 'goldmine food' for bears in her freezer. Will continues, saying *"She said, 'I will never leave my door open again'. And I said 'that is good, but it might be too late'."* Sure enough the next day, at 5 AM, she calls Will to tell him that the bears had torn the siding off her garage to get back in. Will went over to her and they moved the chest freezer inside her house and sprayed the garage down with ammonia [to remove any odors attractive to the black bears]. They left the siding torn off and left the garage door open so the black bears could come in and see that the chest freezer was gone. Over the following days, Will said, she was really careful about keeping the entry way to her home [which was not attached to the garage] clean of any food smells and wiped everything down with ammonia. Her chest freezer stayed in the living room of her house for the rest of the year. The bears came by one more time, but they didn't enter the garage again.

As with the shed in the former example, using a visual sign by locking the garage didn't result in keeping the bears away. In fact, the two bears went to sleep in a tree right outside the garage after eating. This is common behavior for most black bears (Herrero, 2002). They also learn fast where they have found abundant food and return to these sites. In this case, when the owner used the scent sign of ammonia,

she communicated with the bears, telling them to stay out of the garage. Both human and black bear learned to read each other's writing and subsequently adapted their behaviors in such a way that they could continue to cohabit the same area.

Next to visual and olfactory, human and black bear writing and reading on the Front Range also takes place through tactile and auditory communication. The following example of a black bear that broke into a home illustrates communication through these signals, and the way these signals contribute to human and black bear shaping space.

> Sarah, a local resident, called John to report that a black bear had broken into her home, which was the upper part of a two-family-flat. She admitted that she had left the door closed, but unlocked. When she heard a loud noise, she went to see what had happened. There was a black bear that had eaten a bunch of eggs, drank coca cola from the fridge and made a big mess in the living room and kitchen area. When she saw the black bear, she responded by the particularly bearlike sound of howling. The bear read and responded to this sound by running out the door. The noise made by the bear had also alerted the neighbors downstairs. The man of the house said he couldn't think what the noise was. But then, he heard rumbling from the outside stairs and suddenly saw a rather small, he guessed young, bear standing with two paws against the window, sniffing and looking inside. He read the bear's behavior to mean that the bear had the intention to get inside the house, especially since the bear also touched their front door. The bear even tried to get into their car, where the bear left some paw signs in the dust. This all happened in a short period of time. The man of the house then took his air horn, went just outside their home, and from a distance of about 4.5 m used his air horn in response to the bear's acts. At the sound of the air horn, the bear ran away.

In this example, the black bear was possibly initially attracted by the smell of food, supplemented by his/her earlier experiences and rewards. Although the bear's prior history is unknown, the bear's behavior at the lower apartment (sniffing at the window, looking inside and touching the front door), suggests that (s)he has associated homes with a reward (food) inside. Both Sarah and the man from the ground floor responded to the bear's behavior by using (different) sounds. For black bears, this sudden increase in noise is recognized as typical agonistic behavior, a means of intimidation, and demonstrates the other's power, in this case the power of Sarah and her neighbor (Herrero, 2002; Stringham, 2011). In both cases, the bear responded by running away. The black bear is engaged with as a creature with an

agency of its own that influences the selection of which signals to use. The bear also influenced the management strategies suggested by John when he arrived on the scene. After John interpreted the readings and writings of the humans and the bear, he suggested that to prevent the bear from returning and breaking in again Sarah and her ground floor neighbor should also use scent signals to shape their space and communicate its boundaries to that black bear, by applying ammonia along the windows and buying pepper spray. As an additional measure to prevent the bear from entering their home, John placed an electric mat at their front door, a so-called 'unwelcome mat', as he suggested, based on years of experience, that the bear would probably return. Stepping on this electric mat would create a negative association with their home so that the bear would go and stay away. As a result of using this combination of signs (olfactory, tactile, auditory), this particular bear hasn't been seen around this two-family-flat again, witnessed by a camera John placed temporarily near the electric mat. These management strategies were implemented based on the acts of this particular black bear related to the readings and writings of the humans involved in the interaction.

We have given several examples in which black bears are engaged with as individuals with their own agency and with whom communication takes place through the use of a variety of signs. These examples illustrate how the use of multi-sensory writing and reading can contribute to managing the spatiality of human-black bear interactions. We will now examine the use of multisensory writing and reading by both human and black bear in the implementation of Colorado 2-strike management directive for human-black bear cohabitation. Implementing this policy demonstrates various tensions that emerge from the attempt to combine implementing a pre-determined – generic – regulation with a species focus (general human and black bear behavior) that has the overall aim of spatially managing human-black bear interactions, with the local practice of taking the individuality of the humans and black bears and the particularity of the landscape where the interaction takes place, into account. Through our focus on the multi-sensory spatial interactions between humans and black bears we can gain more insight into how these tensions are dealt with in practice, and how humans and black bears seek to achieve cohabitation at the Front Range.

In Colorado, the 2-strike management directive became effective in May, 1994. This state-wide policy aims at preventing and resolving human-black bear conflicts by separating their dwellings as much as possible. A bear is given a first strike when that bear has caused problems. According to John problems are generally interpreted as something involving a threat to human safety. Receiving a first strike means that the bear will be trapped, tranquilized, ear tagged and relocated to 'prime'

bear habitat. Emma states that 'prime' bear habitat is distinguished from 'poor' bear habitat by the nutritional value of its food sources and that this type of bear habitat is generally read by humans as an area where bears would naturally prefer to be. The attached ear tag contains a unique number and a management district specific color (for monitoring the 'problem bear' and indicating in which district the black bear received its first strike). John explains that the tags help wildlife managers in the field to recognize these 'problem bears' if they offend a second time. These tags also imply that bears are treated as individuals, in this particular case as problem individuals, as John explains: "*Whenever we handle a black bear we do have to mark it and that's just because habituated[6] black bears are going to be a potential safety threat*". John's comment offers a solely human perspective on black bear behavior and black bears posing possible threats. When a tagged bear causes problems and is trapped a second time, the bear will be killed. In some instances John uses a 'one-strike policy' for 'extreme' problem bears. He says, for example, when black bears "*break out a door or a window to get in, I don't give them a second chance, they're euthanized*". To the contrary, Rogers and Mansfield (2011), experts in black bear behavior, argue that black bear behavior is often misrepresented. They state that possibly one black bear in about 950,000 will kill someone. Still, they say this misconception of black bears' behavior forms the basis for management decisions. Emma states that it is this personal decision by an individual wildlife manager in the field, based on how they read the signs the black bear has left, that is decisive in determining if a bear will be immediately euthanized, if (s)he gets a first strike and is trapped and relocated, or if (s)he is left 'unmanaged', meaning nothing is done.

Implementing this two-stage policy directive for black bears rests on two assumptions. First, that black bears will adapt their behavior based on their 'correct' reading of human writing (trapping and translocation) and second, that humans 'correctly' read black bear behavior (that the bears will show a preference for what humans have designated as prime bear habitat and choose to stay there). The implication of these assumptions is that processes of reading and writing between humans and black bears are key to the implementation of the 2-strike directive. These assumptions also imply predictable, that is, generally uniform, black bear behavior. However, as we will demonstrate, human and black bear multi-sensory writing and reading constitute an ongoing interpretative process, as a result of which their relationships in a particular spatial setting may be re-arranged at any time. We illustrate this in the following example concerning the spatial interactions between humans and a mother black bear and her cubs in a small local mountain community.

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[6] The idea of habituation is widely discussed in wildlife literature (Rogers & Mansfield, 2011).

One summer night a mother black bear broke into a car in a parking lot before an apartment complex located in so-called 'prime bear habitat' with lots of aspen trees and oak brush (with fattening acorns in fall). The car wasn't locked and the smell of the cantaloupes transported in the car earlier that day attracted the mother black bear and her cubs. Since the mother bear had opened the unlocked car using the door handle, she had most likely been rewarded by finding food in a car before. While her three cubs stayed outside, she entered the car searching for the sweet-smelling food. Unfortunately, the door shut behind her and she was trapped in the car. In her search for food, which – obviously – she couldn't find, and as a result of being trapped, she tore apart the whole inside of the car. Around 3 AM, while she was moving around, she honked the horn and that woke up the owners of the car. After checking on the car and seeing the bear, they called John. Seeing the trapped bear, John and a colleague decided to pull one car door open with a rope. As soon as the mother bear ran out of the car, they shot her with bean bags to establish a negative association with this human surrounding and particularly with cars. The mother bear and her three cubs escaped into the woods.

The next morning, in consideration of Colorado's 2-strike directive, John's district manager decided that the bears should be trapped, because, he argued, they were a possible human safety threat. After permission was granted by the president of the neighborhood homeowner's association to place the trap, fruit was spread at the bottom, and some smashed fruit was put in a small cloth hung inside at the top of the trap. Because of his reading of the bear's behavior of the previous night, John insisted on using fresh fruit as food attractant, including peaches, bananas and melons, because the bear had been attracted by a similar smell – of cantaloupes – before. John used extra olfactory attractant by sprinkling the fruit with cherry juice and spraying anise liquid on top of that. He pointed out that he had been very successful in attracting black bears over the years using the smell of anise. He sprayed more anise liquid on bushes around the trap. Despite these careful decisions based on both reading this particular black bear's behavior and on his own previous experience, the black bear didn't enter the trap and the trap was removed the next day. John said afterwards that he believes that some bears somehow sense that they shouldn't go into a trap and avoid it.

Wildlife managers in this local community have sought to prevent similar – potentially human threatening – situations through the spread of educational leaflets. John explains that, since this wasn't the bears' first break-in, he had

placed a sandwich board with leaflets to take away at the entrance to the community some time ago, telling people to *"Keep windows and doors locked: Bear Alert information here"*. The leaflets told what they could do to prevent bears feeding on trash or other non-natural resources or natural resources on human property, such as fruit trees. However, anticipating bear behavior through human education didn't succeed in this case.

The above described interactions between human and black bear reveal ways in which humans and black bears shaped the space where both dwell. Black bears are intelligent animals, as argued by several wildlife managers in the field and Herrero (2002). Driven by curiosity, a black bear may try again and again to get 'easy' (anthropogenic) food, especially in poor natural food years, and will stay around the neighborhood where his/her food source was found. All human communication to the black bears was intended to spatially regulate their interactions. Both black bear and humans were educated in this community; the mother bear by being shot with bean bags and humans by the use of educational leaflets. This example demonstrates that a focus on multisensory writing and reading, as well as awareness of the individual characteristics of the bear (who in this case had been attracted by the smell of cantaloupe in the car) and the individual experiences of the humans involved (e.g., John's insistence on using anise as an attractant based on successful past experience) are crucial to the space-shaping nature of human-black bear interactions.

However, the example also illustrates tensions that can arise in managing these spatial interactions, particularly related to the implementation of the 2-strike directive. At first the mother bear and her cubs were scared away from the site of the break-in by shooting bean bags with the intention of educating them to stay away from human surroundings. But the next day the bears were again attracted to the vicinity of the car on purpose to implement the 2-strike directive. That the bear didn't enter the trap, and therefore execution of the two-strike directive failed, might be explained, as John argued later, by knowledge previously gained by the black bear to stay away from a trap. The negative association made with the area by shooting bean bags at the bear the night before could also have played a role. In other words, the communication between human and black bear was contradictory (bean bags saying 'keep away' and fruit saying 'come here') and must have been confusing for the bear. Another tension results from the location of the parked car and the community at large, which is – in terms of policy regulations – in prime bear habitat. The application of management strategies in the natural environment of black bears, in fact, illustrates that managing human-black bear interactions is inherently anthropogenic (safeguarding human safety) and political (application of regulation).

More tensions in the implementation of the 2-strike directive emerge when John explains that he sometimes needs to trap a particular black bear:

"How do you know you are catching the correct bear? I can just draw a bear in with the scent of my trap. That bear might have just been cruising through, not doing anything, and then all of a sudden, he smelled this so he came in and got into my trap, OK? Is that the bear that broke into the house? So you have to start looking into everything in there, did it leave any hair behind when it got into the home, how big was its track [. . .] how did it get into the home? To me every bear has got its own method of how it gets entry a lot of times and stuff, so, are we catching the correct bear?"

Here, John makes explicit that black bears differ from each other. Individual characteristics of black bears have to be, and according to John also can be, determined and used to assess if a particular bear is the reported problem bear. John points out that bears have their own agency and shape their own spaces by using their own, individual 'methods'. To determine the particularity of the bear, John needs to read all writing (s)he has left. Consequently, which management strategies he employs depends on the 'methods' that particular problem bear used when creating the problem. In the case of the totaled car, John used sweet smelling fruits to attract the 'problem' bears. Wildlife managers in the field need to understand the particular ways individual bears shape space – what drives them to a particular place – in order to take goal-oriented action; trapping the 'correct' bear, and in general aiming for cohabitation.

If, by accident, it is not the 'problem bear' that is trapped, (s)he still has to be ear-tagged and this entrapment counts as that bear's first strike. John and Gary argue that this decision is justified because an accidentally trapped black bear becomes familiar with 'easy food' in the trap and therefore, they argue, is very likely to subsequently search for other 'easy food' in that human environment. This means that by being trapped (s)he in effect becomes a problem bear and should be managed accordingly. Although implementation of the 2-strike directive is intended to solve the problem of black bears breaking into homes or cars, the example indicates that to manage the spatial interactions between humans and black bears requires case-specific understandings of individual processes of multi-sensory writing and reading.

A last tension is illustrated by John while walking in a small town on the Front Range and demonstrates the importance of the spatial characteristics and dynamics of the landscape in (co-)shaping the communication between human and black bear.

"Number one attraction is the trash fall out by the fruit trees here [in the middle of town]", John starts, while pointing at some crab apple trees, *"and when a bear gets there then they have to rope off the [shopping] mall, so that the tourists and everybody don't get around the bears, from a public safety standpoint. We [wildlife managers] are called to do something with this bear. Well, is that bear really doing anything wrong? Sitting in a tree, feeding on crab apples, it's a more natural forage, it's not trash, the bear is not breaking into your home. [. . .] If we have to go and remove that bear I have to tag it and give it a strike or euthanize it if it's an ear tagged bear. And I'm saying well do something with your trees. The bear wouldn't be there if it wasn't for the trees. To me that's a very significant issue [. . .] you're going to have bear after bear and they are going to learn, they become more and more food conditioned. And subsequently they become more habituated to people and different things, so I think [the problem] really all starts with that attractant."*

John indicates here the struggles he encounters based on the particularity of the landscape in which the human-black bear interactions take place and which management strategy to use. In this case the problem is being caused by crab apple trees with its ripe, sweet-smelling fruits, downtown in a village surrounded by (prime) bear habitat, that attract black bears to feed on them. John prefers to remove the crab apple trees rather than the bears, thus preventing implementation of the 2-strike directive. These fruit trees, similar to trash, can be seen as an intermediary devise connecting humans and black bears. Humans decide to plant these particular ornamental as well as food supplying trees, and black bears – being attracted by the sweet smells – choose to forage on the ripe fruits. Humans and black bears co-shape this landscape.

The above examples of implementation of the 2-strike directive and the various tensions that emerge in practice, demonstrate that aiming for cohabitation at the Front Range requires detailed knowledge about the interactive and dynamic processes between human, wild animal and landscape. It is this combination that determines which management strategy should be used. However, to do so in practice, in light of the tensions we have demonstrated, wildlife managers need to be able to manoeuvre within the policy constraints of the 2-strike policy. Although wildlife managers in the field attempt to navigate within the policy outlines when trying to avoid killing bears, application of the 2-strike directive seems to inhibit attempts to find creative ways to achieve cohabitation.

3.5 Discussion

Our analysis has demonstrated that black bear management, as conventionally understood, fails to grasp the dynamic nature of human-black bear encounters. Using a lens of multi-sensory writing and reading we have demonstrated the various interactions and dynamics of human, black bear and the landscape involved in resolving human-black bear conflicts. Specifically, we have drawn attention to the processes of writing, materialized in a variety of signs or languages (Hinchliffe et al., 2005) and processes of reading, involving multiple sensibilities, by both human and black bear. These writings and readings are translated into a variety of management strategies in order to spatially regulate human-black bear interactions. Examples include educating black bears about where and how to behave 'correctly' by making use of their olfactory language, and educating humans through communicating knowledge about black bears, and, in some instances, by fining people when this knowledge is not correctly applied, as, for instance, concerning bear proof trash storage.

However, to a significant extent, the human-black bear interactions described here do not translate into cohabitation strategies, meaning strategies that involve the space-shaping activities by humans and wild animals that result in the coproduction of landscape. Instead of finding ways to live with black bears, the various writings and readings are employed to act upon the bears and exclude them from human spaces. They are excluded because they transgress the boundaries that humans have set concerning where black bears should and should not be and because they do not behave according to human expectations (Barua, 2014a; Donaldson & Kymlicka, 2011; Douglas, 1966; Philo, 1995; Yeo & Neo, 2010). We have also seen that the operative management strategies rely on generic classifications (Lulka, 2004; Urbanik, 2012), which enable humans to put matter – in our case bears – in the 'right' place (Douglas, 1966) and reproduce the primacy of the human perspective (Buller, 2014). The clearest example is the 2-strike directive, which designates black bears that do not comply with human standards as 'problem bears'. The implementation of this directive has also demonstrated that wildlife managers in the field are forced to juggle strategies and policy that have a species focus, with knowledge and strategies that focus attention on individual humans and individual wild animals (Lorimer, 2010a). While this makes for a complicated balancing act, the shared experiences and often intimate interactions between humans and wild animals are an important part of wildlife management practices, and they also signal the inappropriateness of terms like management or managers. A more explicit recognition of this intimate and affective dimension of wildlife management could contribute to finding new, creative ways to achieve cohabitation. Following these

wildlife managers in the field provides us with the opportunity to gain more insight into the individual and entanglements of humans' and animals' lifeworlds (Barua, 2014b; Gooch, 2008; Ingold, 2000; Lorimer, 2006a; Marvin, 2005; Turnhout et al., 2013).

This brings us to our methodological design. Our way of weaving together ethological and ethnographic registers through our use of multi-sensory writing and reading can be seen as a step forward in the exploration of ethnologies to better understand human-wildlife conflicts and gain insight into how to achieve cohabitation (Barua, 2014a; Bear, 2011; Hodgetts & Lorimer, 2015; Hurn, 2012; Locke, 2013; Lorimer, 2010a). Through our focus on multi-sensory writing and reading we revealed the signs found and communicated in managing the spatiality of human and black bear on the Front Range including intermediary devices (Barua, 2014c). These signs and intermediary devices suggest ideas for the further development of tools for two-way communication that could constitute and accomplish real cohabitation. Our current methodology has two shortcomings. One is that we could have gained more insight into the lifeworlds of human and black bear, such as by following a few individual black bears or families of black bear in their dwellings and in their interactions with humans. Another related shortcoming is inherent to the topic, that is, that the complexity of the lifeworld of human or black bear can never be fully known. However, in order to gain more insight into their lifeworlds and to further develop tools and strategies for cohabitation we suggest that it will be necessary to integrate social and natural science research (Bear, 2011; Lorimer, 2010a). This is important, since management decisions might, for example, be based on misunderstood communication by wild animals, with detrimental consequences for the animal in question. For instance, Rogers and Mansfield (2011) warn that certain behavior by black bears (e.g. lunging, feet slamming down, explosively blowing and clacking of teeth) might be easily read as threat, warning or dominance. They, however, read, based on their years of experience with black bears, these signs as harmless bluster: *"Bluster means a black bear is apprehensive and wants to talk about it"* (p. 174).

As has been indicated by Jepson et al. (2011), influential actors should not be overlooked or marginalized. Along the Colorado Front Range black bears are such influential actors; they are co-constitutive participants in the application of certain management strategies. Particularly with respect to the 2-strike directive, there is a clear recognition of the agency of the black bears; this rule considers these bears to be sentient beings that are able to read the writings left by humans, that can be taught how to behave and where to go, and that can learn from their mistakes. The implementation of this policy also requires intimate interactions between humans

and black bears; humans need to read the black bear writings, they need to write readable signals themselves, they need to identify problem bears and they need to attract, trap and relocate these problem bears. Thus, although formal policy and management regulations are still far removed from the idea of cohabitation, our analysis has shown that the practice of black bear management on the Colorado Front Range does require humans and black bears to get close to each other and learn to understand each other's differences and similarities (Hinchliffe, 2007). This analysis suggests a redefinition of the practice of 'wildlife management', to include black bears as conservation actors (Dempsey, 2010; Jepson et al., 2011).

3.6 Conclusion

In aiming at cohabitation, in the sense that humans and wild animals co-shape spaces, we stress the importance of including both human and wildlife dimensions. This necessitates thinking along with the animals and putting the interaction between both central. As Hinchliffe (2007) reminds us, attributing rights or agency to non-humans will not in itself solve the dilemmas of cohabitation with wildlife, nor will it reduce the increasing number of human-wildlife conflicts worldwide. However, recognizing animal agency and understanding the differences, in this case between humans and black bears, and among humans or black bears (individuality), does matter in approaching human-wildlife concerns (Bear & Eden, 2011; Lulka, 2009). Animals communicate their presence using a variety of senses and possibly also through the use of so-called intermediary devices (Barua, 2014c). Likewise, we must employ a variety of senses to communicate with the animals in a way they can understand. Thus, to *co*habit means that so-called dynamic spaces need to be jointly created in which the needs of humans and the needs of wildlife are addressed simultaneously in order to ensure safety and survival for both (Urbanik, 2012).

To create multispecies communities, we need to leave aside our traditional dualistic-anthropocentric focus. Instead we must further develop a focus on the differences between humans and animals in an interactive and dynamic way. This can be accomplished by highlighting the space-shaping activities of both humans and wild animals that result in the co-production of landscapes. It will be necessary to create management tools in the form of hybrid, dynamic constructions in which these differences are recognized. Therefore, we need to further our understanding of ethnologies in which both the interactions between humans and wild animals, as well as communication through multiple senses are key. In this way, 'microgeographies of cohabitation' might be enacted and sustained through the space-shaping activities of humans and wild animals. To conclude with the words of Hinchliffe (2007, p. 163), *"differences do not become less important as we learn to live together,*

differences grow as we learn to get close". When these differences are recognized in wildlife management practices, humans and wild animals will be able to get closer and find ways to co-shape the landscape in which both dwell.

Chapter 4

Managing wild minds: From control by numbers to a multinatural approach in wild boar management at the Veluwe, the Netherlands

Abstract

Current wildlife management practices rely largely on quantitative data to legitimize decisions, manage human-wildlife conflicts and control wildlife populations. This chapter draws attention to the affective relationships between humans and animals inevitably formed in the practice of producing these data. Based on fieldwork that explores wild boar management at the Veluwe, the Netherlands, we demonstrate the significance of these affective encounters. Specifically, we develop an understanding of mindedness that draws on processes of affective learning in wildlife management practices. To understand this mindedness and how it emerges in wild boar management practices, we use the concepts of affect, attunement and animal subjectivities. First, we show how the numero-politics involved in wildlife management presumes animal minds to be static and generically defined by species, and their presence and behavior to be context independent. Subsequently, we describe the entanglements of humans, wild animals and the landscape, aiming to produce an appreciation of the mutuality that is involved in knowing and conserving wildlife. This, we propose, helps to demonstrate how various – individual or collective – forms of human and non-human mindedness are implicated in management practices but remain invisible and underappreciated in formal accounts. We conclude by explicating a multinatural approach to the management of wildlife that explicitly builds on an acknowledgment of mindedness as a feature of individuals, collectives and landscapes.

Managing wild minds: From control by numbers to a multinatural approach in wild boar management at the Veluwe, the Netherlands

4.1 Introduction

We are at a farm at the Veluwe, the Netherlands where a farmer[1] shows a photograph of uprooted grassland[2]. "*This is done by wild boars. Because of this damage I can forget the plan I made for this season. I can never flatten this field in time and when cutting the grass, the grass will be full of soil and will be of low quality, which causes me economic loss.*" This example is illustrative of the (perceived) worldwide increase in conflicts between humans and wild animals (WWF, 2006; Yeo & Neo, 2010). Such conflicts occur not only in remote areas or in developing countries where dangerous megafauna compete for (rural) space with humans (Knight, 2000b), but increasingly also in affluent and (sub)urban areas. Popular media reports describe this development using phrases such as "*beavers are felling ornamental trees*", "*black bears prowling near the premises*", "*wandering tigers […] come into conflict with people*", "*wild boar marauding Berlin*" and "*hogs are digging through garbage, rooting for acorns in city parks and plowing up golf courses*" (Deutsche Welle, 2017; Mazoomdaar, 2014; Von Drehle, 2013). Many of these media reports argue that the appearance of these animals in villages or (sub)urban areas and the substantial damage they cause results from the fact that there are "*too many wild animals*" (Von Drehle, 2013).

Throughout the world, wildlife that is considered to be harmful is commonly managed by being counted and culled to a pre-set number. In this chapter, we demonstrate how the seemingly rational and objective models used in wildlife management[3] practices to legitimize interventions are not only subject to and the outcome of political struggles, but also obscure the importance of the characteristics of individual as well as groups of wild animals and the local landscape in which they live. As a starting point we examine the counting methods that were employed in

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[1] Where interviews or notes are quoted, participants are described by their relation to wild boar management (wild boar manager, counter, hunter, policymaker, farmer, researcher, local resident) to ensure anonymity. Genders are arbitrarily chosen. When we write about individual wild boars, they are usually referred to as '(s)he', when gender is not known and 'he' or 'she' when gender is known.

[2] The empirical research for this chapter was done by the lead author, except for the Deelerwoud section of the Veluwe, which has been done by the second author.

[3] In this chapter we acknowledge the problematic, anthropocentric use of the term 'management'. We use this term for clarity, because it is commonly used in practices dealing with human-wildlife issues.

wild boar management, including the manipulations to categorize and standardize these counts (Boonman-Berson & Turnhout, 2012; Bowker & Star, 2000; Stone, 2002). In our account of the numero-politics involved in wild boar management practices (cf. Martin & Lynch, 2009), we demonstrate that the interplay between various humans, wild animals and the landscape[4], are crucial to the process of obtaining the necessary field data to fill the prevailing population and habitat models (Eden, 2012). These interplays involve affective relationships. As has been illustrated for water voles in Birmingham, UK (Hinchliffe et al., 2005), corncrakes at the Hebrides, UK (Lorimer, 2008a), bats in Hampshire, UK (Mason & Hope, 2014), Siberian flying squirrels in Finland (Nygren & Jokinen, 2013), and a reindeer herd at the Cairngorm mountain range, Scotland, UK (Lorimer, 2006a), such affective relationships are a crucial element of knowing as well as managing wild animals. Specifically, scholarly work using this notion of affect has helped to bring into view the various ways in which bodies (whether an individual or collective of humans, or wild animals) act upon each other and how they are moved and transformed in the process (Anderson, 2006; Latimer & Miele, 2013; Pile, 2010). It has also highlighted the importance of multiple senses and sensitivities, including not just material forces, but also e.g. changes in atmospheres, which are not or hard to express in language and thus difficult to represent (Hynes & Sharpe, 2015; Lorimer et al., 2017). To denote the process of tuning in to these sensitivities, we draw on the notion of attunement: *'an embodied sensitivity to particular nonhuman differences'* (Mason & Hope 2014, p. 108). To attune implies to open up to other sensitivities, to be moved and affected. This requires passionate engagement on part of the humans, instead of a dispassionate or objective attitude to the human-animal-landscape relations in wildlife management practices (Bradshaw, 2017; Lorimer, 2008a; Tsing, 2010). This also applies to knowledge. Recent literature concerning affective relationships has focused on the importance of affect in getting to know, or even spot, the animals in question, such as counting – only auditorily distinguishable – corn crakes (Lorimer, 2008a), surveying the – nocturnal and to an untrained eye nearly invisible – flying squirrels (Nygren & Jokinen, 2013), and detecting numbers and species of bats (Mason & Hope, 2014).

In much of this more-than-human work however, the 'acts' of the wild animals (presence, absence, and movement) in *response* to the presence, absence and movement of the humans in a particular landscape continue to be underrepresented (for some exceptions see: Barua, 2014c; Boonman-Berson et al., 2016). In this

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[4] In this chapter we define landscape as a lived-in physical environment to which both humans and wild animals affectively relate.

chapter, we develop a more symmetrical[5] approach that addresses the different ways humans *and* wild animals respond to each other as they roam in the landscape. As part of this approach, we introduce an understanding of mindedness that recognizes a variety of animals, such as wild boar, as sentient, clever beings that are able to learn as individuals and as collectives (groups, populations, even multiple species collectives), and that actively relate to particular landscapes (Laurier et al., 2006). Importantly, such a relational perspective implies an understanding of agency and subjectivity as emergent and as produced through learning in practice and through interactions between humans, wild animals, and the landscape (Anderson, 2006; Deleuze, 1978; Latour, 2004a; Massumi, 2002; McCormack, 2003; Pile, 2010; Thrift, 2004). As such, we emphasize the mutuality or intimately entangled back-and-forth character of affective relationships.

Drawing on the works discussed here, we develop a multinatural approach to wildlife management and research that has the explicit intention to shift both the understanding and practice of human-wildlife relationships. Three important considerations have informed our approach. First, this multinatural approach does not rely on an understanding of nature as separate from culture and views the distinction between the wildness and domesticatedness of animals as blurry. Second, the object of management is not individual animals or populations but human-nonhuman collectives. Third, management is an essentially open-ended process and does not seek to fix the present or return to the past (Brettell, 2016; Lorimer, 2012).

As a case study, we use wild boar management at the Veluwe, the Netherlands. Wild boars are unruly animals that are not always easy to live with due to their potential social, ecological and economic impact. This case is therefore also relevant to other 'keystone' species that are subject to being counted, culled and protected, such as wolves, beavers and deer. The management practices we describe involve wild boars, wildlife managers, policymakers, local residents, wildlife researchers, as well as landscape characteristics (including vegetation, soil, fences, and roads). The first author carried out a total of 31 interviews with wildlife managers, policymakers, local residents, wildlife researchers, in addition to organizing four focus groups with local permanent residents, performing prolonged participant-observation of wild boar counting in the Veluwe area in 2010 and 2011, and participant-observation of wild boar hunting. Charting the formal modes of management and generating an account of the affective relations and the emergence

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[5] We promote a more symmetrical and contextual perspective as the focus for wildlife management and conservation research, without presuming an ideal of full symmetry between human and animal rights or interests.

of animal subjectivities implicated in these formal modes of management is methodologically challenging (Hodgetts & Lorimer, 2015). To analyze how wild boars are known, we had to read between the lines of the written forms and understand how the numbers that these forms include came about. This required closely attending to the process in which elusively present and constantly moving boars were being counted, or their presence estimated. With a training in sociology, ecology and the basics of ethology, the first author, who undertook the interviews and the fieldwork, sought to move between the formal scientific approaches of investigating humans and animals on one hand and an open approach that is sensitive to the subjective or 'affective experiences' on the other hand (Barua & Sinha, 2017). This involved contrasting her own experiences and observations with those of the human informants in the field, and with formal ecological and ethological accounts of wild boar behavior (Buller, 2015). Additionally, she had to learn to be affected by the wild boars as they emerged 'multinaturally', in response to the processes in which they are known, managed, and drawn to places while avoiding humans. In doing so, she was able to grasp the various intuitive knowledges that are present in wildlife management practices (Kirksey & Helmreich, 2010).

The results of this methodological approach are presented in two separate sections that document different elements of the wildlife management practices under study. The first discusses the production and use of numbers. Here, we discuss the more formal aspects of wildlife management: we offer an empirical account of how these numbers came about and we connect our results with relevant literature to develop and illustrate the concept of numero-politics. This, then, provides the basis for the second section where we highlight the affective and learning dimensions of wildlife management that both informs and is a prerequisite for this numero-politics to take place. Moreover, we juxtapose our findings with relevant literature in order to develop and illustrate the concept of mindedness. We conclude our chapter by proposing a multinatural approach to wildlife management that emphasizes the continually changing and affective interactions between humans, wild animals and landscapes, thus exploring the potential of non-routine and non-standardized ways of knowing and managing wildlife.

Figure 1. Location of the research area 'Veluwe' in the Netherlands.

4.2 The numero-politics of wild boar management

The Veluwe is the largest terrestrial natural area of the Netherlands and one of the largest of Northwest Europe (see Figure 1). The area of 91,200 hectare is characterized by forests, heathlands, drift sands, many roads, some agriculture, and several villages. The area is subdivided in a variety of segments, which are managed by a variety of owners. The area is therefore far from a single site; some parts are connected and others fenced off – to include or exclude particular animal species – and the management regimes for these species vary as well. The presence of wildlife (red deer, roe deer, wild boar) is a key feature, attracting many recreationists. Simultaneously, these wild animals, especially wild boar in our case, also feature in public debates about wildlife problems, such as the dozens of car collisions involving wild boar, and wild boar that destroy hundreds of hectares of crops (Dusseldorp, 2017; Frijters, 2011; Gruben, 2017; Guldemond et al., 2015; Omroep Gelderland, 2016). According to national policy, wild boars are not allowed to roam around outside the Veluwe, and within the Veluwe they are not allowed to enter villages and agricultural zones (Klashorst et al., 2009; Spek, 2014). These areas are designated as zero-tolerance zones, indicating 'non-accessibility' for wild boars, and are sometimes physically demarcated by (wild boar resistant) fences. Wild boars that enter zero-tolerance areas are to be shot immediately by licensed hunters. To prevent wild boars from becoming too burdensome to human activities including traffic, gardening and farming, as well as to prevent what is considered ecological damage

in natural areas, current wild boar management relies on controlling the total number of wild boar number at the Veluwe.

Counting wild boar at the Veluwe is a legal prerequisite to initiate population control which constitutes the culling of wild boar so that the population is reduced to the desired maximum allowance of wild boars (Koninkrijksrelaties, 2012, 2017). This maximum allowance is derived from an ecological model for the Veluwe that is based on food availability, population size and what is called the 'ecological carrying capacity' of the area, on the assumption that wild boars have access to the whole area (Groot Bruinderink et al., 1999; Groot Bruinderink & Hazebroek, 1995). In 2009, due to a change in policy, a – numerical – fluctuation in maximum wild boar allowance per year and per subsection or 'Fauna Management Unit' (FMU) was authorized, instead of one fixed number for the entire Veluwe. Depending on available natural resources and in anticipation of possible wild boar nuisance, the pre-set maximum allowance of wild boars across the Veluwe, set in springtime, was permitted to fluctuate, between 1,080 (in years of low availability of nutrition) up to 1,580 (in years with high availability of nutrition) (Gedeputeerde Staten van Gelderland, 2009; Klashorst et al., 2009). This was based on the assumptions that in years of low food availability (especially acorns and beech-nuts) wild boars tend to move a lot to search for food and in years of high food availability wild boars tend to move less, resulting in a relatively low probability of wild boars venturing into human surroundings (Boitani et al., 1994; Keuling et al., 2009).

The projected maximum allowances are highly contested at the Veluwe. A wildlife researcher summarizes the debate by stating that although policymakers and wildlife managers will argue that they rely on an ecological model, the maximum allowances that are derived from this model are actually choices for a specific number of boars which can fluctuate around a median number. Her researcher colleague adds that wild boar management 'pretends' to employ objective scientific research in their management and in the determination of the maximum allowances, but that the assumptions in the model might not be correct. For instance, Keuling and colleagues (2009) assume that wild boar might also move less in years of poor food availability. Their movement, these authors suggest, is the result of *"a high individual flexibility in spatial behavior"* (Keuling et al., 2009, p. 151). This shows that the determination of the maximum allowances and the distribution of boars per FMU and per year is not unequivocally accepted as objective or scientifically valid. Rather, it is a compromise negotiated by the different owners, wildlife managers, policymakers and local residents. This compromise is based on a blend of political, social and ecological factors, of which the most prominent are: (natural) food

availability, sufficient visibility of wild boars for recreationist/humans and the likelihood of nuisance to humans caused by wild boars (Klashorst et al., 2009).

Annual wild boar counts are organized during two evenings in seven districts of the Veluwe. Depending on the district between 28 and 180 people, including wildlife managers, hunters, and guest-counters, will be involved in counting in pairs or individually at early evening until dusk. Experienced counters who know the area are teamed up with counters from other areas to double-check their counts. Counts are recorded on a form that incorporates location details as well as distinct categories to be filled in: time and direction of arrival of the wild boar, time and direction of leaving, how many sows (female), boars (male), young adults (one to two years old) and piglets are counted and, in addition, some characteristics of the individual or group. This information is considered important to determine whether any double counts have occurred, since the same group could have moved to neighboring areas. As the example below illustrates, wildlife managers engage in discussions about how to integrate separate counting events to come up with the final numbers:

> *"On the first evening 39 boars are counted here, on the second 24. How many double counts do we incorporate?" [Colleague wildlife manager answers:] "Those 24 are right, they were around the whole evening. I was there too. The others are double counts plus a few more, we have to decide how many." "So, how many does that leave?" [Colleague:] "One count is wrong, leave that. Those are double and those three are young adults." "So we add three young adults, then we are correct?" [Colleague:] "Yes, we have to stop here."*

After the actual counts are decided upon, a so-called correction factor is applied which is based on food availability and health of the wild boar population (Vereniging Wildbeheer Veluwe, 2015). As explained by a wildlife manager: "*The numbers of piglets have been underestimated every year, so we added a correction factor for the growth of the wild boar population to better assess the existing population size of wild boars*". He adds: "*Less mast in a particular year means that sows have hardly any offspring, that boars frequently die due to malnutrition. If there is plenty of mast [a good mast year], sows – often – have two or more litters in a year, and relatively large numbers of boars survive the winter season*".

So, while ostensibly management is purely a matter of counting, in the process of counting itself and in the calculations that lead to the eventual numbers, a range of other modes of knowing boar and the landscape plays a role. As explained by a wildlife manager, while driving around at the Veluwe, correction factors are

determined based on nutritional conditions which vary from year to year: *"I estimate the available mast production for wild boars by looking at the blooming of the trees in spring"*. This wildlife manager points to some oak trees in the distance and says: *"Those oak trees have been eaten bare by caterpillars [the Oak processionary]. These trees won't produce any mast this year. I'll take that into account in my assessment"*. As with the determination of the maximum allowances per FMU, the correction factors are not based on specific mathematical calculations or particular ecological models. They are based on the field experience of local wildlife managers and on the data collected in previous years. Ultimately, wildlife managers can calculate how many boars they need to cull when both the maximum allowances and the number of wild boars in a particular year are determined. Since 2001, hunting quotas (specified by numbers of males, females, young adults and piglets) were within a range of approximately 2,500-5,000 wild boars per year for the Veluwe (Schoon & Schrauwen, 2016). This means each year, between 70 to 82% of the wild boars living in the area is to be culled.

This section has shown that wildlife management 'by numbers', as observed at the Veluwe, tends to make use of ecological models such as population models and habitat models (Bear, 2006; Martin, 2015; Nowak, 2015). These numbers produce a certain 'object stability' and this promotes a sense of order and control. Bowker and Star (2000) call this process 'naturalization': "*stripping away the contingencies of an object's creation and its situated nature*". At the Veluwe, wild boars are treated as objects to be counted, calculated and, ultimately, to be culled. However, representing individual animals as numbers and calculations is problematic. It presumes that species identity is the only relevant attribute of wildlife and that species presence is context independent (Bear, 2006; Bowker & Star, 2000; Roth & Bowen, 1999). So, in the translation from animals to numbers, the specifics of the animals, the relations between counted and counters and the landscape in which these relations are situated disappear from view and get lost. As Roth and Bowen (1999, p. 746) explain for the case of lizards: "*The transformation we observe here is that from a physical, three-dimensional animal into […] a zero-dimensional number*". Indeed, with respect to wild boar management, the reasoning behind the numbers – including the more intuitive methods based on site specific estimates and personal inferences – is often obscured. In the following section, we will foreground those and take them as a starting point for an alternative account of wildlife management. Specifically, we will highlight the affective relations between human, wild boar and landscape, the multi-sensory processes that are deployed, and the mindedness and subjectivities that emerge.

4.3 Affective relations and mindedness

Research has recognized the individuality and learning capacity of a number of animal species, including primates and elephants. For instance, Smuts (1999) describes how she quickly learned about baboon individuality when she went to the highlands of Kenya to study baboon behavior: "*Each one approached his or her relationship with me in a slightly different way*". One came close to her very slowly, another marched over to her and touched her, another stared but didn't touch her, etc. And she describes that between baboons, a variety of friendships arise in their lifetime in which individual characteristics, "*such as experience and calm disposition*" (p. 155) play a role. Barua (2014a) argues in his research on crop raiding behaviour of elephants, that individual elephant behaviours, elephant personalities, herd behaviour and landscape characteristics all impact elephant management practices and inform the prevention of human-elephant conflicts. In this chapter, we introduce the notion of mindedness to capture this intelligence in a way that does not situate it exclusively in a 'brain' envisioned as independent from bodies, conspecifics, and the wider environment, rather this notion recognizes it as relational; constituted in the interactions between human, wild animal, and landscape (also see Laurier et al., 2006 for a similar conception of mind as distributed and decentered). Put differently, mindedness involves dynamic processes of shared learning, thinking with, remembering and mutual adaptation.

The notion of mindedness helps understanding the affective relationships that emerge in wildlife management, including the embodiment, and multi-sensory exchanges between humans, wild boars and the landscape, as well as how animals respond to and participate in management interventions (Alcayna-Stevens, 2016; Barua, 2014c; Boonman-Berson et al., 2016; Despret, 2016; Haraway, 2008; Mason & Hope, 2014). This includes counting, hunting and the production of wild boar knowledge; knowledge of which it is no longer meaningful to say it is exclusive to humans, as perhaps can be said of the ecological models running on office computers, far removed from the grunting of a stressed sow and the mixed smells of ripening corn in the morning. Also wild boars are learning to be affected in relation to humans and the landscape, they too are 'becoming with' rather than merely performing a universal and static mode of 'being boar' (Castree, 2003; Despret, 2004). Additionally, also the landscape can be seen as a participant, as it is constitutive of wild boar-human relations; by being situated in a landscape, wild boars and humans assume certain behaviours and, in a sense, become who they are. These relations are illustrated by the following counting experiences:

> *"We [a wildlife manager and I] drive to an open spot to see if we can count any wild boars. He, says: "a [large male] pig comes here at 21.15. We know them!" However, he didn't show up until 22.15. He guessed that maybe the pig was late due to the heavy rainfall late afternoon."*

To illustrate the more intuitive ways of knowing in wild boar management through multi-sensory exchanges, we turn to an occasion when we (a wildlife manager and I) are planning to leave our observation post after having counted the entire evening:

> "*Wild boars entered the spot near dusk (22.15). We observed the wild boars and noted their characteristics. It was about time to leave, but the wild boars were still roaming around. Then the wildlife manager started making a short farting sound. Later, he said he sometimes uses a roaring sound and explained that he decides on the spot which of these sounds to use to communicate with the wild boars. This time, he used the sound to entice the wild boars to leave the spot. He had to try this several times before, finally, one female wild boar responded and made a short grunt. Subsequently, she and the others walked a few meters to the edge of the feeding area (away from and opposite to our observation post) and continued feeding on the corn that the wildlife manager had thrown there earlier that evening as bait. The female boar who had grunted was still alert, with head and ears lifted. After he repeated the farting sound one more time, this female turned around and walked away and subsequently, all the wild boars left the spot, walking quietly into the forest, away from us.*"

This example shows that to count and manage wild boars at the Veluwe, this wildlife manager needed to actively tune in on the wild boars and the wider ecology of the landscape. He had to learn to be affected by wild boars and this enabled him to communicate with the female leader of the group. This for him involved recurring periods of observing wild boars and experimenting with multi-sensory forms of communication, which in the case of wild boars, are principally non-visual. As the way in which the female wild boar responded to his signaling exemplifies, wild boars also actively relate to their surroundings, learning to interpret previously unknown features (Morelle et al., 2014). For instance, it is generally known that wild boar movement is affected by various landscape characteristics: weather conditions, seasonal changes, seasonal cycle of tree-life, presence of soil fauna, food distribution, availability of resting and farrowing sites (Graves, 1984; Morelle et al., 2014). And studies have indicated that wild boars may reduce or expand their movements as a response to hunting or other disturbances in their home range (Keuling et al., 2008). In this case, we might suggest that the female wild boar

identified the particular sound made by this wildlife manager as unfamiliar, but not (acutely) threatening and it thereby initiated the boars' unhurried leave-taking. However, not all responses of wild boars can be understood based on our human mind and senses. For instance, animal ecologists and ethologists have argued that wild boars are able to record and use information from their own movements, such as speed, distance, direction, by means of their vestibular system, muscles, joint receptors, or optic flow (Morelle et al., 2014). Wild boars use these so called 'self-motion cues' in a strategy called dead-reckoning or route-based navigation. In this sort of navigation wild boars are also assumed to make use of the Earth's magnetic field and the position of the sun or stars. This navigational activity of wild boars doesn't occur randomly, but is a memory-based movement (Morelle et al., 2014). These studies suggest that wild boars equally have the capacity to learn to be affected by and 'tune in' on their environment, as they are affected by humans. Thus, wild boars moving around in social bonds, constantly communicating with each other, uprooting fields and rerouting tracks, navigate and (co-)create landscapes made up of traces, signals and memories.

These human-wild boar-landscape – mutual – affective relationships in wild boar management practices are of particular importance to prevent scaring the wild boars from such locations as the wildlife observation post in the previous example. The wildlife manager later explained that if we had left the observation post while the wild boars were still roaming around, we would have interrupted their activities and made them run away; the boars would not just have been frightened, but could have developed a negative association with this particular feeding area. Preventing a negative association is important, because the same spot is also used for hunting them. Indeed, ecological research conducted by Morelle and colleagues (2014) support the idea that wild boars have a site-specific awareness. They argue that wild boars select activity zones not randomly but "*by means of directed or memory-based movement between familiar environments*" (p. 19). In our example, the wildlife manager relies on his (affective) knowledge of wild boars, the specificities of the site and his ability to tune in and be sensitive to the behavior of the wild boars to decide on a strategy to prevent them from developing a negative association with a specific location. The wild boars' subsequent response demonstrates the two-directional character of this affective relationship.

We now turn to an example of a counting evening with a different wildlife manager that illustrates collectives of wild animals as affective beings that learn, remember, adapt, and tune in to their direct environment:

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"After waiting a while, a family (one female, one young adult, six piglets) – family A – entered the observation area at 19.30 where the wildlife manager had thrown corn as bait earlier that evening. Family A started feeding on the corn. A few minutes later another family (one female, three piglets) – family B – also entered the area. Female B's behavior was described by this wildlife manager as 'nervous': she walked back and forth on the spot, didn't feed on the corn, and frequently walked to female A and young adult A while making a grunting noise. Female A and young adult A responded by moving away a few meters from female B. At 19.50 female A and young adult A left the spot, leaving the piglets behind, feeding on the corn. The wildlife manager stated that we would soon hear a grunt from female A from the woods to call the six piglets. Indeed, after 10 minutes we heard a grunt, but we couldn't observe the boars in the woods. The six piglets left the spot. After the piglets left, the 'nervous' female B displayed even more intense 'nervous behavior' by moving and looking up more frequently, and still not feeding. At 20.20 another family (one female, two young adults and two piglets) – family C – entered the area and started feeding on the corn. Their presence resulted in female B provoking all newcomers by grunting, moving towards them and occasionally pushing them. After 10 minutes of observing this interplay between female B and the newcomers, female C had moved relatively close to our observation post and we heard her cry out, a loud grunt, after which family C rushed away from the area. About a minute later family B also left the spot. The wildlife manager told me later that the grunt by female C, was probably a warning sign as she might have sensed us nearby. He also indicated that the 'nervous female' was probably an old female based on his observation of her relatively long tusks in comparison with those of females A and C."

This example emphasizes that wild boars can be observed to move in ways affected by individuals as well as collectives, in this case other wild boar families. The displayed wild boar interactions suggest that female B had been affected by family A versus C in different ways, which was observable by the frequency and intensity of her behavior in response to each family's presence. The other wild boars (family A and C) were also affected by the behavior of female B, and as a result they moved around the area or left. What made female B behave 'nervously' and 'provoke' the other boars at the observation area remains elusive. Another wildlife manager suggested later, based on his field experience in counting wild boars, that sometimes families of wild boars are chased away from counting spots by other wild boar families because of the corn on these spots which contribute to the survival of piglets,

as it is an extra food source. This might have been the case in this example. In fact, the use of corn as bait to count (and later hunt) the wild boars seems to have contributed to creative and non-predetermined responses by the involved wild boars. For instance, as explained in the former example, family C might have – previously unforeseen – developed a negative association with this particular spot.

That also wild animals, and not merely humans, continually adapt and respond to constantly changing, complex environments, is also recognized by a wildlife policymaker in explaining that it is difficult to manage so-called 'city boars': those wild boars that are born, raised and remain in suburban or city centers. He explains: *"those wild boars that know the built area, they only want to live there [...], and piglets born in city centers don't know their way to the forest"*. To manage these boars and remove them from a town center, a wildlife manager explains, is to "*shoot out their memory*". Also, local residents observe that wild boars actively relate to their surroundings and inventively respond to being managed, such as a resident telling that she sees wild boars sleeping near her house, just across the road, when she hears hunters shooting in the nearby nature area (shots can be easily heard): "*because they know it is safe here"*, as shooting in residential areas is prohibited. Indeed, also boar behavior scholars have argued that wild boars cooperate within groups, have a sophisticated level of social organization that includes learning to respond to signals from conspecifics, and learn even across generations (Boitani et al., 1994; Focardi et al., 2015; Gabor et al., 1999; Graves, 1984; Keuling et al., 2009; Morelle et al., 2014; Poteaux et al., 2009; Vetter et al., 2016). Nonhuman knowledge is therefore not just a matter of individual brains, but is distributed in collectives and situated in landscapes.

Some management practices usefully illustrate the ability of wild boars to tune in to and learn from their environment. For instance, a wildlife manager conducted an experiment to get wild boars across a gate, despite skepticism of colleagues:

> *"He showed me a gate through which wild boars could pass from one area to another. Initially, the boars did not use this gate and seemed unaware of the possibility to move to the adjacent [resource rich] area. He decided to instruct the boars to use this gate. First, he looked around for wild boar signs near the gate. He showed me the trail he had found and pointed to a small tree which was rubbed by wild boars and contained some wild boar hairs. He explained that he had put some corn on the trail between this tree extending beyond the gate. He did that day after day. After a few weeks he*

> *noticed that he had succeeded: he found wild boar hair on both sides of the gate, which indicated that the boars had started to use the gate."*

The example shows that the wildlife manager experimented with pro-active strategies with the idea that humans and wild boars could share the same landscape and he spoke enthusiastically and with a gleam in his eyes about this experiment. However, such experimentation in wild boar management with different ways of 'being with', is – yet – underdeveloped. Rather, current – experimental – attempts at the Veluwe in finding ways of 'living with' or cohabitation, have been expressed by adaptations in landscape characteristics, especially the availability of nutrition on wild boar movement (e.g. topsoil stripping at roadsides), and by adaptations in their hunting methods, especially alternating more intense hunting in potential conflict areas with areas with no hunting with the assumption that the remaining wild boars will avoid the conflict area. While potentially valuable, these interventions are not based on a multinatural understanding of wildlife management; a topic to which we turn in the next section.

4.4 Towards a multinatural approach

In this chapter, we have presented two interrelated accounts of wild boar management in the Veluwe, the Netherlands. The first of these focused on formal management strategies, their reliance on numbers generated by counts and model projections, and the processes and practices involved to produce these numbers. The second has zoomed in on the affective relations involved in knowing and managing wild boars. Specifically, we focused on the responsive process between humans and nonhumans which included remembering and tuning in to the ever changing, complex environment in which they roam (Bekoff & Pierce, 2017). Our analysis has made clear that while current wild boar management is based on and legitimized by control of their numbers, in the practice of wild boar management wild boars are not just known through being counted as passive and generic functional objects, but as active, affective, and minded beings. It is precisely through their unruly and sometimes unforeseen responses to being managed, that they contribute to the production of – also intuitive and non-representational – knowledge and to the emergence of novel wild boar management practices. In other words, although not formally recognized, management in practice already draws on the mindedness of individuals and collectives of wild boars. We suggest that these processes of affective learning, and the mutual attunement and understandings of mindedness they involve, can be used to develop a multinatural approach to wild boar management.

A multinatural understanding contrasts with a perception of unity, of 'species-thinking', and of the assumption of a singular Nature that can be straightforwardly known (Lorimer, 2012; Van Dooren, 2014). Rather, multinaturalism conveys a sense of living in and with the world, that recognizes the multiple and unexpected differences between humans, animals, and the various other living and non-living parts of the landscape (Hinchliffe, 2007; Latour, 2004b). And, in that, it recognizes the active involvement of the various humans and nonhumans in processes of learning, remembering and adapting. A multinatural approach to wildlife management that emphasizes the continually evolving and affective *interactions* between humans-wild animals-landscapes requires, and promises, non-routine and non-standardized ways of managing and knowing (Despret, 2016; Latour, 2004a).

What we are proposing is challenging and raises questions about how exactly affective relations can be made to flourish in practice and how a multinatural approach can be cultivated that works with wild boar and draws on their ability to learn, remember and adapt, as individuals, collectives and across generations. For instance, when and where should wildlife managers attune to individual wild boars, when to collectives of wild boars, and how can they take into account the animals' creative ways of responding to being managed? Next, we will discuss four considerations (or implications) for multinatural wildlife management.

The first consideration involves the implications of other (non-representational) ways of knowing in wildlife management. A multinatural approach implies the acceptance of the impossibility of full control and the abandonment of strategies that rely on numerical optimization of the presence of designated target species that are based on generic abiotic landscape categorizations and on static notions of the nature, ecology, and behavior of wild boar. We are not suggesting that numbers are useless, but that a multinatural approach could produce and employ numbers, as well as other forms of knowledge, not to standardize but to enable diversity and multiplicity in the ways in which we learn to relate to wild boar – and they to us – and to the landscapes we share. Examples of how wildlife management practices (might) deal with non-formal, non-representational forms of knowing are wild experiments, such as in two nature areas in the Netherlands (Oostvaardersplassen and Deelerwoud). Here, managers have experimented with management without counting and population control (Frijns et al., 2016; Lorimer & Driessen, 2014). In the case of Deelerwoud (a section of the Veluwe where since July 2014 counting and culling of wild boar has been abandoned), wild boars are able to freely enter and leave the area. According to a local Deelerwoud wildlife

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manager, wild boars seem to have become less shy and those born at Deelerwoud seem to stay there, even in seasons when nutrition in the area is low (Frijns et al., 2016). Experiments such as at Deelerwoud enable the creation of new affective relations between humans, wild boars and landscapes; new ways of 'becoming with' (Despret, 2004) and articulate new ways of human-wild boar-landscape management.

However, and this is our second consideration, to straightforwardly grasp and systematically represent a multinatural approach to management is invariably difficult, and to some extent impossible. This is partly due to the impossibility to find words to describe affective experiences and the bodily skills and multi-sensory attunements they involve, to account for what is happening in management practices, and to justify specific management interventions. To grasp and write about affective accounts in this research, we sought to integrate practical and disciplinary ways of knowing to find an 'interdisciplinary middle' (Barua & Sinha, 2017, p. 16). This involved bringing together (affective) learning processes by both the researcher and the research-participants in field practices. The researcher has learned to be affected, to be moved, and to attune to the wild boars and wider ecology of the Veluwe during consecutive field visits. In doing so, we have generated management stories about human-wild animal-landscape encounters. These stories include not merely human affective learning processes, but also the stories generated and experienced – in whatever way – by the animals involved, akin to the making of storied places by penguins and flying foxes (in Van Dooren & Rose, 2012). Collecting and telling these (human and nonhuman) stories is a multidisciplinary or even transdisciplinary task, since it involves experimenting with new forms of conversations between natural scientists (e.g. ethology, ecology) and social scientists (e.g. geography, sociology) (Barua & Sinha, 2017; Mason & Hope, 2014), as well as between these and wildlife managers. These conversations, in which a variety of affective, ethological, ecological, sociological and field knowledge is shared, encourage creative thinking about how to accomplish multinatural management.

This brings us to our third consideration about how to legitimize a multinatural approach. A multinatural approach promotes thinking in terms of 'problem locations', rather than generic species characterizations (Bekoff & Pierce, 2017). Thinking in such terms, not only promotes place-specific management, it also means that in different areas, different management strategies might be deployed. For example, in some areas the focus can be on protecting agricultural land or rare flora against being uprooted by wild boars, while in other areas wild boars can be allowed to enter and roam. It may also be the case that management strategies that are not effective in one area can be effective in another, for example because in that

area the wild boars are not yet familiar with these strategies. As a result, management will vary in different settings, articulating varying human-animal-landscape relations (Van Dooren, 2014), and it will involve the emergence of a multitude and temporally dynamic set of so-called 'human-animal living accomplishments' (Laurier et al., 2006). This is particularly important for a diverse area like the Veluwe with its many different humans (counters, hunters, local residents, farmers, recreationists), individuals and groups of wild boars, and varying landscapes (drift sands, heath, forests, roads, agricultural fields, villages). Arguably, the Veluwe provides a unique opportunity to further develop and experiment with a multinatural management approach that draws on already existing ways of knowing and managing wild boars.
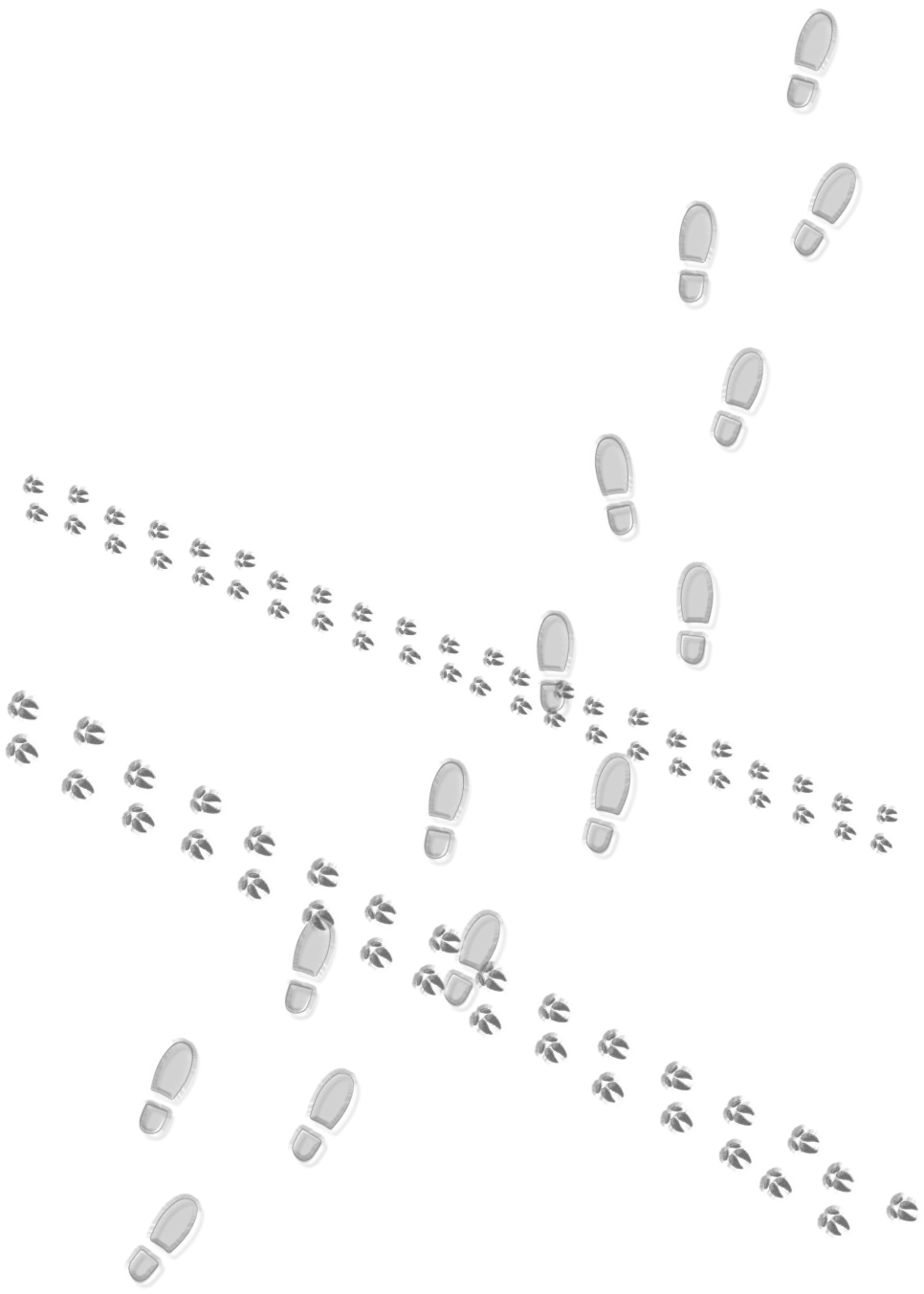
Our fourth and final consideration concerns the affective relations involved. A multinatural approach requires not only that managers deploy an affective attitude and willingness to let go of (the ideal of) control over nature, but also that a range of other humans develop affective relations with the boars – involving recreationists, residents, farmers, and the wider public. Such an affective attitude and abandonment of control includes allowing wild boars to become with the landscapes and with fellow boars and other animals in unspecified ways. Preferably, management strategies are non-lethal since these reinforce, rather than disrupt, social relations among wild animals, including their ways of learning and remembering. Examples of such strategies in wildlife management are the use of sheepdogs to protect little penguins from red foxes in Australia (Bekoff & Pierce, 2017), and the use of non-lethal paintballs to scare black bears away from human surroundings (Boonman-Berson et al., 2016). Yet, as part of this management approach, it can be argued (although this may be contested) to be important to also accept that sometimes wild animals, who we got to know in some way as subjects, might starve, or would need to be killed. Killing might still be considered necessary when dealing with a particular conflict situation. However, a multinatural approach will refrain from the idea of making wild animals 'killable' based on numbers alone (Despret, 2016; Haraway, 2008; Stone, 2002). Deciding to kill particular animal subjectivities requires managers to become disaffected by the respective wild animal(s). As a result, wildlife managers, might be trained to – depending on the situation – observe animals through a parsimonious filter, alternated by an awareness of being with these other wild animal(s) and being sensitive to and use these other ways of 'knowing and sensing' to attune to these wild animals to e.g. either track them for counting or hunting purposes.

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4.5 Conclusion

The multinatural approach we have developed in this chapter involves a general reconception of what management is. Instead of control, management now emerges as an ongoing effort to balance the needs of all the participants while recognizing that not all needs can likely be met, and as tentative and place-specific, acknowledging that no management decisions are set in stone. It involves not only attunement to one particular animal species in what is assumed to be a timeless and stable ecosystem, but requires seeking to attune and to be affected by a variety of species, including rare species, as well as landscape characteristics, such as the presence of resources for particular animals, which vary, change and impacts differently on each locally present organism.

The further promotion and development of this multinatural approach requires, as we have tried to do in this chapter, the collection of diverse management stories about human-wild animal-landscape encounters (Brown et al., 2009; Gabriel & Connell, 2010; Sutherland et al., 2004; Van Dooren & Rose, 2016). Sharing such place-based stories among wildlife managers as well as other actors involved, can catalyze learning from practical field experiences, promote awareness of affective ways of knowing, and enable the deployment of affective management strategies. So, it is only fitting that we end our chapter with a brief excerpt of one encounter that we felt revealed the new affective relationship between manager and boar. For this encounter, we go back to the section of the Veluwe called Deelerwoud, an area which has been experimenting with 'no culling' management: *"Suddenly we discerned a large male wild boar standing in thick brushwood, watching us. After about half a minute, he ran off into the forest, after which the wildlife manager said to the wild boar, but also to himself, and to me: "You go sort it out yourself now boy"."*

Chapter 5

Blurred boundaries in wildlife management practices

Abstract

Human-wildlife conflicts have been increasing at alarming rates over the last few decades. Wildlife management practices deal with preventing and disentangling these conflicts. However, which approach should be taken is widely disputed in research, policy, in-the-field-wildlife management and local communities. One key aspect in deciding which approach should be employed concerns the drawing of boundaries, between human and wild animal, between territorial spaces, in the use of certain categorizations and in the implementation of policy regulations. Coexistence between humans and wild animals is propagated worldwide even as human-wildlife conflicts increase. To achieve coexistence, wildlife management practices need to adopt corresponding management strategies. In this chapter it is argued that, in aiming for coexistence, wildlife management practices employ apparently obvious boundaries, which may, however, be adjusted to prevent and disentangle human-wildlife conflicts. Subsequently, it is argued that coexistence between humans and wild animals can only be attained by adopting an integrated approach to human-wildlife-interactions, merging knowledge from the natural and social sciences, and wildlife management practices. This argument is illustrated by exploring the dynamics of boundary drawing in the practice of wild boar management at the Veluwe, the Netherlands and black bear management on the Colorado Front Range, USA. These wildlife management practices display respectively both strategies of confinement and strategies of alignment. In conclusion, wildlife management practices aiming for coexistence require both strategies. Strategies of alignment, however, are prerequisite to opening boundaries between humans and wildlife in order to manage their conflicts as relational endeavors.

Blurred boundaries in wildlife management practices

5.1 Introduction

'Unexpected Visitors: Wildlife Invasions in Our Towns and Cities', 'Urban Invasion: Wily Foxes Embrace Easy City Life', 'Oh, Deer: Wildlife Invades Gold Coast', characterize the headlines of media reports from around the world. How to deal with wild animals invading human territories is a topic of much debate and research (Bradshaw, 2009; Knight, 2000b; Thompson, 2002). Wildlife managers must decide what, if any, strategy to take to prevent wildlife crossing the boundaries of human property or to disentangle conflicts arising from these perceived transgressions. However, which approach should be taken is much disputed in research, policy, in-the-field-wildlife management and local communities. Potential wildlife management strategies can range from tranquilizing, relocating or killing individual 'problem' animals, confining them to particular areas by placing physical barriers such as fences, controlling or extirpating entire populations of these 'problem' animals from a particular area to acceptance of the possibility that human-wildlife conflicts might occur while taking no particular safety measures. Other strategies aim at humans rather than animals, such as education and enforcement of rules designed to prevent human-wild animal conflicts. Examples of such human-focused strategies include media attention (TV, radio, newspaper, internet) to reach many people at once (Cassidy & Mills, 2012), educating individuals concerning their behavior, and fining individuals for behavior such as not storing their trash 'animal-proof' or for illegally feeding wild animals.

These examples illustrate debates about a variety of the boundaries which come into play when dealing with human-wildlife issues. These include boundaries between human and wild animal, between territorial spaces, between ignorant and competent people, and between individual animals and whole populations. For instance, Milton (2000, p. 242) argues that conservation is a boundary maintaining exercise; *"In order to conserve the things that constitute nature, the boundaries that separate them must be maintained, and in order to conserve nature's 'naturalness', the boundary between the human and the non-human must be preserved"*. The latter involves not only categorizing wild animals, for example according to problematic or not, or humans versus wild animals, but also requires a spatial ordering to establish where particular wild animals (should) belong. Lulka (2004), discusses that to control certain wild animal populations, wildlife management plans need to shift focus from static boundaries in defining territorial spaces towards dynamic boundaries in which movement is key. He argues that a focus on movement provides

a way to link humans and wild animals together in order to better manage human-wildlife interactions. Baruch-Mordo et al. (2011) argue that education as a management strategy should highlight pro-active enforcement, for example by dispensing warning notices, in addition to providing information. Using a combination of educational strategies increases the chance that a variety of people will be affected, and is therefore more likely to produce a change in human behavior when dealing with wildlife. In another debate about boundaries, Bear (2011, p. 299) says that a focus on individual animals might *"offer considerable potential to engage* and mobilize wider human interest"*, and especially *"offer an alternative perspective to the often quantitative discussions"*, which are typically about populations of animals. But, as he warns, a focus on individual animals does not mean that human characteristics should be attributed to animals. This touches upon a currently sensitive issue concerning the attribution of agency to animals in scholarly literature dealing with relations between humans and wild animals (Donaldson & Kymlicka, 2011; Philo & Wilbert, 2000; Wolch & Emel, 1998).

In this chapter wildlife management practices dealing with human-wildlife issues are explored regarding how and what kind of boundaries are drawn to manage human-wild animal interactions and how and to what extent coexistence between humans and wild animals is aimed for.

To achieve human-wildlife coexistence, I argue in this chapter that wildlife management practices should continue to make use of boundary drawings when choosing management strategies. At the same time, I question the need for rigid boundaries and rather direct the attention to the creation of more dynamic, flexible boundaries which focus on aligning human and wild animal behavior in order to seek a form of coexistence. The concept of coexistence is described in terms of human and non-human animals who engage with each other in a collective endeavor. Coexistence can be best understood as a 'co-production' by various humans and wild animals (Francis et al., 2012) and a move beyond essentialized, taken-for-granted representations of nonhuman others (Bear, 2011; Philo & Wilbert, 2000; Philo, 1995). It is particularly stated in this chapter that thinking in terms of management strategies drawing rigid boundaries (as described by the notion of confinement), ignores calls to go beyond the boundaries of humans versus wild animals and instead to co-exist with wildlife (Cassidy & Mills, 2012; Hinchliffe et al., 2005; Hinchliffe & Whatmore, 2006; Lorimer, 2006a; Lorimer, 2008b; Noske, 1997) by using flexible, dynamic boundaries (as described by the notion of alignment). To make these arguments a number of points have to be taken into account. First, speaking in terms of conflict situations is problematic, as Bradshaw (2009, p. 246) argues when demonstrating the adversarial use of the term 'human-elephant conflict': *"A*

sympathetic elephant 'bad guy' and an erring but well-intentioned human 'good guy'". It is debatable if human-wild animal conflicts involve a dispute between human and wild animal or between different humans, and it is questionable whether humans and wild animals are worlds apart or co-construct the spaces in which they dwell (Ingold, 2005; Johnston, 2008). Therefore, in this chapter I instead address human-wild animal interactions to emphasize their mutual relationship. These interactions between humans and wild animals entail processes of 'action-reaction'. The processes are not necessarily symmetrical, but both human and wild animal behavior is taken into account in co-constructing their interactions. This means that to avoid problematic interactions, whether for human or wild animal, their mutual relationship, their interaction, is central. Additionally, imposing on wild animals and/or humans the requirement 'to behave' in a particular way by using management strategies of disciplining will never result in an end product that specific people, such as researchers, in-the-field-wildlife managers, policymakers or local residents, had in mind because the focus is on domination rather than on achieving a cooperative relationship and solution (see also Bradshaw, 2009, p. 163 and further). Thinking in terms of mutual relationship also contributes to coexistence between humans and wild animals.

In addition to the problematic division in relationship, Bradshaw (2009, p. 235) also states that *"nature's rhythms and patterns do not conform to those created and imposed by Western humans"*. In other words, there is no such rule as *"one management strategy solves all human-wildlife issues"*. Anthropogenic influences also play an important role here. For example, humans might intend to manage human-wild animal interactions by placing fences, but, despite these fences, the presence of wild animals in certain areas might rather be regulated by the distribution of natural food resources for wild animals which change on a yearly or larger time scale due to – intentional or unintentional – anthropogenic influences such as global warming, extensive forest fires, logging practices or human population growth. These factors have an effect on the management of human-wild animal interactions and call into question the use of rigid boundaries (Bear & Eden, 2011; Lorimer, 2006a).

This chapter first discusses coexistence in wildlife management practices and focuses on the dynamics of drawing boundaries. Subsequently two wildlife management cases illustrate these dynamics in managing human-wild animal interactions: wild boar management at the Veluwe, the Netherlands, and black bear management on the Colorado Front Range, Colorado, USA. The dynamics described vary at different levels and the boundaries depicted are not only blurred, but also

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entangled throughout with respect to the described wildlife management practices. The two contrasting cases reveal different ways of approaching wildlife management aimed at coexistence between humans and wild animals and illustrate two concepts that contribute to the attempt to achieve coexistence: confinement and alignment. They also illustrate how living in a multispecies community requires approaching these multispecies communities in a 'multispecies' way. This can be done by viewing humans and wild animals, as well as populations and individuals as aligned, intertwined entities, instead of thinking of them as separate entities that have to be confined by and investigated employing particular scientific disciplinary traditions such as social sciences and natural sciences. This new way of thinking may result in the creation of management strategies that include strategies of alignment, or combine strategies of confinement and alignment, in their aim for coexistence between humans and wild animals in scientific as well as local wildlife management practices (Hinchliffe & Whatmore, 2006; Latour, 2004b; Lorimer, 2008b; Turnhout et al., 2013).

5.2 Drawing boundaries with wild creatures

As early as 1995 Philo had expressed his concern regarding the socio-spatial processes of exclusion to which wild animals were so often being subjected. He described them as being excluded from city spaces, where humans are supposed to live and work, expelled for a variety of reasons including being considered polluting, disruptive and discomforting. To understand these socio-spatial processes, it has been argued that these so-called invading wild animals should be (re)included in contemporary research on human(-animal) geography (Philo, 1995). This generated a variety of ideas, amongst others the concept of coexistence between humans and wild animals (Buller, 2014; Hinchliffe & Whatmore, 2006; Knight, 2000b). Coexistence in this chapter refers to the idea of humans and wild animals as active participants in spatial interactions. Their mutual relation is key, which involves processes of connection and division (Latimer, 2013). Specifically, this perception of coexistence makes possible a more dynamic appreciation of differences between areas and between humans and wild animals. For instance, populations of wild animals are viewed as active masses that vary – both on a population level and on an individual animal level – in their behavior in different spatial settings (Hinchliffe et al., 2005), instead of static masses that have to be confined to certain areas to fit pre-defined classifications (Lulka, 2004; Urbanik, 2012). According to Hinchliffe and colleagues' argument (2005), the involved wild animal(s) come to be seen as fellow subjects in a dynamic process of coexistence. Thus, aiming for coexistence assumes that both humans and wild animals actively co-shape the space in which

both can dwell. It expressly rejects the idea of wild animals being treated as objects or as simply 'other entities' to be acted upon by humans. As a result, from the perspective of coexistence, preventing and disentangling human-wildlife conflicts implies mutual adjustment on the part of both humans and wild animals as they learn to live together. Relationships between humans and wild animals, in contrast to those between humans-domesticated animals (pets), are intermittent and fleeting (Bear & Eden, 2011). Therefore, studying as well as managing human-wild animal interactions becomes a dynamic, situated, relational affair.

Drawing boundaries remains useful in wildlife management practices, since boundaries reduce the spatial extensiveness and complexity of the world to manageable units (Jones, 2009). However, hard lines, black-and-white thinking, and deeply rooted dualisms can result in unproductive boundary disputes about, for example, wildlife conflict management (Keulartz, 2009). Keulartz suggests moving away from thinking in terms of boundaries towards thinking in degrees employing his notion of 'gradualization': *"a broad continuum, a hybrid middle ground"* (idem, p. 36). Urbanik (2012) describes the notion of hybridity in (individual) human-animal relationships, denoting that relationships differ depending on place (Lulka, 2009). For example, an encounter with a free roaming wild boar differs from an encounter with a captive wild boar at a children's farm. The individual relationship between human and wild animal is emphasized. Subsequently, Urbanik expands this concept by examining the processes of power in these human-animal relationships. These processes of power are important, she argues, since, depending on the place of an encounter, different power relations exist. For example, humans may feel that they have control over the wild boar in the children's farm, but feel less in control when coming across a wild boar in an 'open space'. Similarly, processes of power may be able to explain which actions might be taken in specific circumstances. For example, when a wildlife manager encounters a black bear sniffing in a garbage can, this might result in management actions aimed at capturing and relocating the particular black bear because that bear might create problematic situations, while when a tourist – who is excited to spot a black bear during his/her holiday – encounters the same black bear sniffing in a garbage can, (s)he might grab his/her camera to make a picture, further leaving the black bear alone. The above described variation in the drawing of boundaries is what I call in this chapter 'the dynamics of boundary drawing'.

Specifically, I explore in this chapter the dynamics of boundary drawing in wildlife management practices to clarify the kind of control that is mobilized to deal with human-wild animal conflicts. This is done by focusing on the doings, sayings,

and spatialities of both humans and wild animals. These doings, sayings and spatialities have implications for what management strategy will be taken. For instance, Marvin (2000) discusses the killing of foxes in the English countryside and concludes that the dispute surrounding these killings is what these foxes do rather than what they are. In his research it is the illegitimate killings of the fox – because the fox kills game birds and domesticated livestock which are only supposed to be killed by human beings – that causes the fox to be perceived as a pest and legitimizes controlling foxes through fox-hunting. While, he states, the fox as such, was seen as an attractive animal in his research and people spoke positively about the physical body of the fox. Here, it is what the fox does that makes it a 'pest fox'. Cassidy and Mills (2012) depict the 'urban fox' as a central character in transgressing socio-spatial boundaries when it enters 'human spaces', in their case entering a home in East London in 2010. They discuss the consequential confusion concerning the 'correct' space of belonging for humans and 'urban foxes', and the confusion about the 'accompanying' behavior of an animal categorized as wild versus one categorized as urban, such as the fox, or as a domesticated animal, such as a dog (as pet). These ambivalent spatial and representational conceptualizations of human-wild animal relations have implications for which wildlife management strategies are applied in practice. In the case of the 'pest fox' in the rural country side (Marvin, 2000), it is hunted, in the case of the 'urban fox' (Cassidy & Mills, 2012), it is disputably considered to be both a pest, which legitimizes its killing and confinement, and feral, adapted animal that humans are persuaded to tolerate and align with.

Common practice in dealing with human-wildlife conflicts is to control or discipline the wild animals. This can take different forms, depending on how the boundaries are drawn. In drawing these boundaries, processes of power, as described by Urbanik (2012), are important. For instance, Rinfret (2009) argues that the reintroduction of wild animals involves targeting controlled encounters between human and wild animal. The involved 'wild' animal is argued to be a "*human-constructed, representation of the wild*" that is disciplined by using sophisticated technology such as 'shocking collars' for wolves – when they come close to a farm they are shocked – , and GPS monitoring devises for condors – to track daily activities in order to protect them in their 'natural' surroundings. These animals are confined to certain locations by the use of technological devices.

Palmer (2001), who particularly defines human-animal interactions as power relations, distinguishes between disciplinary techniques interfering in internal human-animal practices, such as training, taming and teaching in a variety of ways

(including the offer of reward and affection), and those interfering in external human-animal practices, such as confinement and physical punishment (including trap-and-relocate and 'shocking collars'). Although these practices are intertwined, she argues that these relationships can easily turn into human domination over wild animals, when the desired disciplining of the wild animals is not having the desired effect. As a result, the animals revert to being treated as 'things' (objects) rather than 'beings' (subjects) in a relationship.

Both Palmer (2001) and Rinfret (2009) discuss the doings (actions) of wild animals that precede the introduction of disciplinary devises in terms of 'acts of resistance', which constitute reactions to human acts. Despite their depiction of wild animals as actors, they do not go on to consider a possible alignment between humans and wild animals that would move beyond targeting domestication and disciplining wild animals. The disciplining of wild animals also brings into question the ambivalent notion of how wild animals are defined, and challenges the distinction between domesticated and wild animals.

A particular distinction between domesticated and wild animals is made in policy regulations which impact the management of human-wild animal interactions. In the case of wild animals, no one is assumed to be – in social or legal terms – responsible for the animals. The responsibility for the acts of these animals and their related consequences is debatably a (social) collective issue, one which could be attributed to the wildlife manager, to the 'injured' (human) party or to the wild animal in question. In the case of domesticated animals, the owner is responsible for any attacks that occur. The attributed responsibility is an especially delicate issue in the implementation of wildlife management strategies, especially when potential economic losses play a role. Are these losses to be considered the consequences of nature or can they be attributed to a particular human party?

Last but not least, an important boundary having an impact on the application of management strategies in wildlife management practices dealing with human-wild animal interactions is between the social and natural sciences. Traditionally, the behavior of wild animals is investigated and subsequent wildlife management strategies are proposed by natural scientists. They determine how the wild animals forage, reproduce, and survive in a particular ecosystem and how many of a specific wild animal an ecosystem can sustain (Thompson, 2002). It is only recently that the human factor has also been recognized as an important focus for research and management concerning human-wildlife conflicts (Knight, 2000b). Humans may interpret the behavior of wild animals in a variety of ways. Their observations can be paired with emotions ranging from excitement to intense fear

with respect to the particular wild animals under study (Cassidy & Mills, 2012). The subsequent management strategies vary accordingly. Consequently scholars suggest that there is a need for (more) social science research to deal appropriately with the increase in human-wildlife conflicts worldwide (Baruch-Mordo et al., 2009; Knight, 2000b). Although it is acknowledged that both fields of knowledge – the one dealing with the behavior of wild animals and the other dealing with the behavior of humans in areas where both dwell – are necessary to solve human-animal conflicts, the question of how these knowledge fields can be aligned in constructing management strategies aiming for coexistence has been underexplored.

In the following sections two contrasting cases illustrate the dynamics of boundary drawing in managing human-wildlife interactions. Wild boar management at the Veluwe is examined first. The empirical data on wild boar management is drawn from prolonged participant-observations of wild boar counting in the Veluwe area in 2010 and 2011, hunting observations, a total of 30 interviews with in-the-field wildlife managers, researchers, local residents, policymakers, four focus groups in the area, and several key documents as well as media attention given to the subject in the period that the research was conducted and the years immediately thereafter. This case clarifies the notion of 'confinement' by analyzing how and what kind of boundaries are drawn to manage wild boars and how that contributes to coexistence between humans and wild boars in the Veluwe area. Particular emphasis is placed on the drawing of boundaries through the choice of a management strategy and how particular management strategies of confinement are implemented.

Next, black bear management on the Colorado Front Range, Colorado, USA is examined. The empirical data concerning black bear management is drawn from five days of participant-observations with in-the field-wildlife managers in the summer of 2012 during a two month stay on the Colorado Front Range, USA, 37 in-depth interviews with researchers, policymakers, in-the-field-wildlife managers and local residents, three focus groups with local residents and several key scientific, policy, and educational documents on black bear management in this region. This case clarifies the notion of 'alignment' by analyzing how and what kind of boundaries are drawn to manage the black bears and how that contributes to coexistence between humans and black bears on the Colorado Front Range. Particular emphasis is placed on the relationship between human and black bear in deciding what management strategy to use and how to implement particular management strategies of alignment.

The main characters are referred to by titles such as in-the-field-wildlife manager, researcher, policymaker, local resident and local activist for reasons of

anonymity and analytical clarity. When individual wild animals are discussed, they are usually referred to as '(s)he' (when gender is not known) and 'he' or 'she' when gender is known.

5.3 Wild boar management at the Veluwe

The Veluwe is the second most important nature area in the Netherlands. It is approximately 100,000 ha made up of forests, heathlands, drift sand and some cultivated fields, and is dissected by several roads. Human settlements are found within the area. An important feature of the Veluwe is the presence of wildlife such as wild boar (*Sus Scrofa*). Due to the area's spatial arrangement, current wild boar management is multi-spatial. In principle, wild boars are allowed to roam 'freely' within the Veluwe. However, this 'free-range' is restricted by several fences constructed to prevent the boars from invading certain areas such as human settlements, highways and agricultural zones. These areas are designated as zero-tolerance areas by national and provincial policy. Their boundaries are key to wild boar management, especially in terms of preventing problematic human-wild boar interactions, as maintaining public safety is a top provincial priority (Provinciaal Bestuur van Gelderland, 2002). In general then, to achieve coexistence between humans and wild boars while simultaneously maintaining public safety at the Veluwe apparently requires placing physical dividers in the landscape in order to control wild boar movement and regulate the number of wild boars permitted to roam in particular areas.

Physical dividers, for example (electric) fences preventing wild boars from entering certain areas, such as gardens, can be found all over the Veluwe. Wildlife road barriers are another way of separating wild boars and humans. Some of these road barriers have been specifically developed to block wild boars while allowing access to other wild animals, such as red deer. Another strategy for physically separating wild boars from humans is the establishment of so-called 'grazing areas' for wild boars. These grazing areas are resource rich, largely open areas which wild boars are attracted to, as an in-the-field-wildlife manager explains when we pass one: *"Wild boars come here because there is food and they know it is safe because it is fenced"*. The safety of these areas for wild boars is related to a management strategy for population regulation and is applied outside these 'safe-zones': culling. Before examining population regulation in detail, it is important to note that these grazing areas not only control the movement of wild boars, but also control the movement of tourists visiting the area. As an in-the-field-wildlife manager puts it:

> *"Also tourists know their way to this [grazing] area, because they know they can spot wild boars here and the infrastructure is designed in such a way that it restricts these people to walk on the trails, and thereby limit disturbing these animals."*

In other words, the development of these grazing areas, as well as other physical dividers in the landscape, can be seen as strategies of confinement controlling the movement of both wild boars and humans in the area.

Among in-the-field-wildlife managers one physical divider which employs physical punishment is particularly disputed: chasing away. This strategy is implemented when wild boars cross the boundary of zero-tolerance areas. An in-the-field-wildlife manager explains it in this way:

> *"[Wildlife managers] used to scare them away with fireworks [in town centers]. At first, that was effective, but soon they became used to that and weren't frightened anymore. So we stopped doing that. We need to keep shooting these boars, because you know, once they are completely habituated, you don't get rid of them anymore from your town center…"*

He argues that wild boars are intelligent animals, but don't comply with human defined rules about staying away from zero-tolerance areas. As a result, he argues, extirpation of wild boars in these zero-tolerance areas seems necessary. His understanding of the relationship between humans and wild boars has changed from teaching these wild boars how to behave to domination by killing them.

However, in managing human-wild boar interactions the most significant approach entails regulating the size of the population. This approach assumes that a particular population size will prevent these animals from entering zero-tolerance areas in their search for food. To regulate population level a variety of boundaries are drawn. This regulation is *"based on research on wild boar carrying capacity in each indicated wild boar habitat"* (Provinciaal Bestuur van Gelderland, 2002, p. 22). Wild boar habitat at the Veluwe is specified by their foraging behavior and ecological characteristics. This wild boar carrying capacity, denoted here as the maximum allowance of wild boars, must first be determined. It is initially derived from a scientific model constructed in 1999 (Groot Bruinderink et al., 1999), based on the actual food availability for wild boars on the Veluwe, without any supplementary feeding. However, in practice, the maximum allowance is in reality based on preventing any problematic situations between humans and wild boars. As a policy maker notes *"we just look per area [organizational unit] how many animals we want […]"* and his colleague adds *"the main aim is safety here, fluctuations are*

not tolerated". This means that social concerns rather than ecological – food related – concerns determine this maximum – desired – allowance of wild boars at the Veluwe. This maximum is rigidly observed as will be shown. Thus, to determine the maximum allowance of wild boars at the Veluwe a variety of boundaries are affected: rather rigid spatial boundaries (zero-tolerance areas, organizational units), and a blurred boundary between reliance on ecological knowledge about the number of wild boars the Veluwe area can sustain versus reliance on the socially preferred number of wild boars all play a role in the determination of the maximum number of wild boars at the Veluwe. Importantly, in the determination of these boundaries wild boars are treated as objects – units or numbers – rather than animals that move around.

To arrive at this maximum number, it is first necessary to ascertain the current wild boar population. To do this, wild boars are counted yearly during two evenings in late spring (May-June). Wild observation posts are established to count them and the counts are divided in categories: sex (female, male), and age (young adult, piglet). Wild boars are attracted to these posts by bait laid down there. This means that these wild boars are disciplined in order to count them. To discipline the wild boars, wild boar managers accumulate detailed knowledge about their behavior and employ this knowledge to train the wild boars to come to these observation posts so they can be counted. As one in-the-field wildlife manager explains, they distribute bait on the same spot every day at the same time for three weeks before the counting. At some places this is done by hand, at others it happens automatically. Wildlife managers themselves are trained to count the boars using a variety of camouflage techniques, such as using grease clothing, situating themselves 'against the wind', and making no noise. Although wildlife managers indicate that they 'try to think like a wild boar', so that the boundary between human and wild boar seems to be blurred, still, the relationship is one of domination. In this interaction between humans and wild boars the count, not the relationship itself, is central.

Once actual wild boar numbers are approximated, the number of wild boars to be culled is calculated. First the wild boar count is corrected for the number of piglets still to be born. The correction factor used is based on expected food availability in summer/autumn, the experience of in-the-field-wildlife managers and data from former years. After corrections are made, the pre-set maximum allowance of wild boars per area is subtracted from the total number calculated for that specific year. This yields the number to be culled. Over the last five years this fluctuated around 3,800 or 4,000 wild boars to be culled at the Veluwe annually, leaving about 1,100. To cull the calculated number, a hunting table is set up that describes the

number of wild boars to be culled, divided in categories of sex (female, male), and age (young adult, piglet), and divided per organizational unit as well as for the whole Veluwe. The resulting hunting table shows – again – that, here, wild boars are being treated as objects; they are represented by numbers that do not refer to particular – individual – animals. In this hunting table they are just numbers.

The culling of wild boars corresponds to the procedure for counting wild boars; wildlife managers discipline wild boars to come to observation posts by using bait, and discipline each other (based on their knowledge of wild boar behaviors) by using a variety of camouflage techniques. Hunting follows on an individual basis or through so-called 'situated' hunting where several hunters hunt close to each other, positioned in fixed observation posts, attracting the boars using bait and with the intention to hunt as many wild boars as possible in one evening. The latter strategy covers larger areas than can individual hunting and is used by preference in areas close to human-populated areas, the so-called 'risk' areas. These two culling strategies use different spatial boundaries to achieve the legally defined population size of wild boars and manage human-wild boar interactions. Besides culling that is spatially restricted to observation posts, some wildlife managers 'go after the boars', as a wildlife manager explains, by observing where a boar has recently been rooting, putting bait there and waiting near that spot until they return. As with counting wild boars, here too humans discipline the boars in their need to cull them. In culling wild boars during hunting season (July-January, possibly until March), a categorical shift in focus occurs, from hunting piglets in summer, to targeting older age groups and poorly fed boars later in the season. The reasoning behind hunting piglets in summer is to reduce population size relatively quickly. This is a clear indication that wild boars are treated principally as numbers, with the aim being to approximate the desired population size as much as possible.

Thus, in order to regulate the population size of wild boars, rather static boundaries are drawn to manage human-wild boar interactions (zero-tolerance areas, organizational units) and wild boars are primarily treated as objects to be acted upon (counting and culling) and divided into particular categories (sex/age/problematic). In this way, individual wild boars roaming the Veluwe 'disappear' in numbers of maximum allowance and to be culled/not-culled. The relationship between human and wild boar in population regulation can be best described as one of power (dominance) and of numbers.

Current wild boar management as described above is severely criticized. For example, this critical remark is made by a local activist who questions the current way of regulating population sizes: *"Management shouldn't focus on numbers […]*

we stick too much on models, too much on 'there are too many' wild boars. […] we need to adapt [to wild boars] or fence no-go areas". He questions controlling human-wild boar interactions through a focus on models and numbers. He touches on the issue of (mutual) relationships between humans and wild boars, saying that we – humans – need to adapt to them in order to live together at the Veluwe. Thereby he specifically addresses the idea that wild boars are wild animals and not just numbers to be acted upon. He does indicate, however, that spatial boundaries might still be necessary and thus a need for physical dividers in the landscape.

The need for – strict – spatial boundaries to control interactions between humans and wild boars at the Veluwe is also supported by most permanent residents. Generally speaking, permanent residents are not too concerned about the numbers of boars present in their surroundings and suggest that they are able to take their own measures to manage their relation with the boars. As a local resident states, *"I like to see wild boars, but I wouldn't like to see a wild boar disrupting my yard every night. I would place a fence"*. When residents place fences as a physical divider around their garden, it can be regarded as a type of confinement, imposing restrictions in the movements of both humans and wild boars.

In contrast, wildlife managers emphasize the need to control wild boar numbers and behavior in order to maintain public safety. Next to regulation on population level, this also includes controlling the individual behavior of wild boars (here interpreted as killing so-called problematic wild boars). For instance, an in-the-field wildlife manager said that he once saw a male wild boar walking along the road several times, and that boar had to be shot, because he was likely to cross the road and could cause an accident. The anxiety over potential accidents is expressed in the next statement by a wildlife manager. He also stresses the importance of regulating population size and meeting the desired population target:

> *"...when we don't meet the targets [to hunt a certain amount of wild boars]...when somebody is killed by a crossing wild boar, national media jumps in and points at us that we did a bad job, now somebody is killed."*

The above interchanges reveal a distinction in focus concerning current wild boar management between wildlife managers and residents. Wildlife managers justify the applied wild boar management strategies of confinement by emphasizing the need to control populations of wild boars in order to maintain public safety. Thereby they treat wild boars as a group, in plural, with a strict focus on numbers and restricted spatial presences accomplished through the creation of zero-tolerance areas. As a result of drawing and maintaining these tight numerical and spatial boundaries,

humans and wild boars are in general separated from each other. Seen in this light, co-existence means living next to each other, not co-shaping the environment where both dwell. Residents, on the other hand, look towards relaxing the sharp boundary between humans and wild boars and instead focus on – individual – interactions with wild boars and alternative management strategies to align with wild boars, given the spatial limitations in densely populated areas.

To conclude, current wild boar management at the Veluwe can at best be described in terms of management strategies of confinement. Humans control the wild boars by drawing and maintaining sharp spatial boundaries, focusing on and managing their numbers and assigning them to a variety of categories (problematic, age, sex). By using these management strategies of confinement, the wild boar as animal disappears in numbers. In contrast, the next case illustrates strategies of alignment in which the relationship and interaction between human and wild animal is centralized.

5.4 Black bear management on the Colorado Front Range

Over the last decades, the Front Range of the Colorado Rocky Mountains, USA has become a heavily human populated area. The amount of (sub)urban areas has more than tripled state-wide since 1960 (Center of the American West, 2001; Colorado State Demography Office, 2014). Considering the increase in humans living on the Front Range, researchers argue that it is not surprising that human-black bear conflicts have rapidly increased in this period (Baruch-Mordo, 2007). Since researchers indicate that the black bear population at the Front Range is increasing as well, conflicts between humans and black bears are even more likely to occur (Vieira, 2011). There is a growing need to manage interactions between human and black bear on the Front Range, on the one hand to reduce human-black bear conflicts and secure public safety, and on the other hand to achieve the state-wide wildlife aims to enhance and sustain populations of native, desirable non-native and migratory wildlife populations for the use, benefit and enjoyment of Colorado residents and visitors (Colorado Wildlife Commission Policy, 2009).

The overall aim in Colorado is to achieve coexistence between humans and black bears. In order to further this aim and manage the interactions between humans and black bears, two (complementary) directives have been introduced. They prescribe strategies concerning how to manage these interactions and how to deal with conflict situations. The first directive (2-strike management directive) is a state-wide directive, the second directive (trash directive) is an – optional – directive for

municipalities. The implementation of the two directives with respect to the management of human-black bear interactions is described below.

The 2-strike management directive, introduced in May 1994, is a state-wide policy aimed at guaranteeing human safety. This directive is put into effect when a black bear is considered to be a 'problem bear' by an in-the-field wildlife manager, for instance because (s)he broke into a home searching for food and/or threatened people. The bear in question will then be trapped, tagged, and relocated to 'prime' bear habitat (first strike). A labeled problem bear trapped for a second time (second strike) will be killed. The intention of this directive is to keep black bears out of cultivated areas and give them a second chance by providing them with their own – safe and natural – surroundings. In other words, this policy aims at separating human and black bear dwellings to prevent problematic situations and assumes that black bears are intelligent animals that learn from previous experience. In-the-field-wildlife managers confirm that black bears are intelligent animals and that it is possible that they might be disciplined by implementation of this directive (trapping, relocating) and stay away from certain areas. But most in-the-field-wildlife managers regard implementing the 2-strike directive as problematic, as one manager explains:

> *"You can take a bear you can haul it a hell of a long ways but if it is a territorial bear it's gonna be back. You know and so that is another reason why I can't tell these people [who had a conflict with that bear] with a straight face we are going to trap this bear and your problem is going away."*

In fact, in practice most in-the-field-wildlife managers experience safeguarding human safety and black bear safety as a balancing act. One in-the-field-wildlife manager explains it in this way: *"Combining the fundamental mandate to protect the public and protecting that bear is tough"*. One difficulty this balancing act creates involves the drawing of boundaries in that an in-the-field-wildlife manager needs to decide whether a particular bear is to be considered a 'problematic bear' and having done so then needs to decide whether or not to implement the 2-strike directive. These boundaries include spatial boundaries designating where black bears are allowed to roam and where not; did that bear cross a particular boundary? They also include categorical boundaries about what black bear behavior determines if (s)he is a problem bear. In fact, in-the-field-wildlife managers will try to determine what boundaries have been crossed by either black bear or human in order to discover the causes of the conflict they need to solve. Thereby they examine the actual interaction between human and black bear, to see what human behavior might have influenced the 'problematic' behavior of a particular black bear (e.g. feeding bears), what black

bear behavior might have influenced humans to act in a specific way (e.g. breaking into a home). Wildlife managers deal with the difficult task of drawing appropriate boundaries that meet the needs of both human and black bear on a daily basis in bear season (approximately April-November each year). In practice, this also implies that implementation of the 2-strike directive is not always the best solution in solving human-black bear conflict situations according to many in-the-field-wildlife managers at the Front Range. They examine individual human-black bear interactions and subsequently determine what strategies to implement with respect to either black bear and/or human. In the following example an in-the-field-wildlife manager explains the difficulty of determining what interactions have occurred and the difficulty of drawing spatial boundaries to decide what management strategies to implement.

He describes a recent event when he received a call from a local resident reporting a black bear break in. The lady of the upper story of the house said it was her fault that the bear came in because she left the door open. The bear could smell food, entered her home and drank coca cola and ate a bunch of eggs and made a big mess in the living room and kitchen area. When the lady heard the noise, she came out and howled at the bear and the bear ran out the door. The wildlife manager talked to the lady the day after to determine what should be done. The main question he needed to answer was whether this bear had been aggressive to human beings. Did (s)he stand his/her ground did (s)he huff, bluff charge which would indicate that (s)he is a bear to be concerned about, in other words a problem bear. In this case it sounded like the bear took off, and in agreement with the neighbor living beneath the lady, they decided to place an 'unwelcome' mat at the front door. This is an electric mat that when the bear returns – which is probable according to the wildlife manager, because (s)he has associated the house with food – and steps on it, (s)he will get a shock and hopefully that will deter her/him from breaking in there again because it will create a negative association with (this) house(s). Within the framework of the 2-strike directive, the in-the-field-wildlife manager needed to separate the dwellings of human and black bear by gathering detailed information about the actual human-black bear interaction. The bear entered a home, which was considered as problematic behavior by the wildlife manager; the bear crossed the line of human property. But since neither the lady of the house nor the neighbors below had been hurt, and the bear took off, it was decided to discipline the black bear and not give her/him a first strike. In other words, (s)he wasn't trapped and the 2-strike directive wasn't implemented as such. In fact, as many in-the-field-wildlife managers indicate implementation of the 2-strike directive to be problematic, they tend to avoid applying the 2-strike directive by disciplining both the respective black

bear(s) and the human(s). Therefore, as in the example, information about the behavior of the black bear and the humans in question is needed before deciding what management strategy to use in addition to separating their spatial dwellings as much as possible.

Avoiding implementation of the 2-strike directive is also an applied strategy used by many local residents and Bear Aware volunteers, as one explains: *"Every time when there is a bear call we have to figure out how to deal with that bear and it could be several different things that we might try before we hit the one that works the most"*. She explains that first whatever attracted the bear has to be removed, and this mostly means the people need education (as in the case of the lady who needed to lock her door). If they decide to condition the bear, different strategies are examined:

"Using paint balls or rubber buckshots [rubber bullets and beanbags shot by a shotgun, stings the bear – but it doesn't hurt him – , and makes a lot of loud noise] so the bear will run away, or use pepper spray or an airhorn gun [compressed air that will make a lot of noise after pushing the button]. These airhorns work quite well at first but then the bears get used to that; it scares them if they are close but if they are not very close they just look at you. [We also consider] putting security things on top of the dumpsters and the trash that the bears do not like."

While the 2-strike directive is aimed at disciplining black bears, trash directives in some Colorado towns aim at disciplining humans. The aim of the directive is to get humans to store their trash in black bear resistant trash containers. If people don't store their trash properly they risk a fine. But before fining people, they are educated about trash storage and about how to prevent black bears feeding on anthropogenic food sources in general. This is done by in-the-field-wildlife managers as well as by Bear Aware volunteers (neighbors talking to neighbors). Next to talking with people, they also make use of brochures, bumper stickers ('Keep bears wild', 'A fed bear is a dead bear'), newspaper articles, internet websites devoted to 'Living with wildlife', TV and radio broadcasts, etc. In other words, disciplining humans to 'behave Bear Aware' is diverse. For instance, one Bear Aware volunteer describes her activities in her neighborhood:

"I really worked in my community and south of here where there is a real problem with bears getting in the trash. I did that last fall. I had their brochures, but I also had my own. And I went to over 300 houses and left notices at their doors when they were not at home."

If people still don't comply with the trash directives in the respective towns, they risk a warning notice. If this still doesn't result in black bear proof trash storage, people are fined (the amount of trash-fines differ per municipality, but are generally around 100 dollars). The trash directive specifies the trash can as a boundary that is drawn between human and black bear and if storage is bear-proof, coexistence between human and black bears seems to be possible.

Next to trash-directives some towns also revised their building code to keep bears out of homes. These are generally towns in which an increased number of black bears breaking into homes had been observed. In one such building code, it is stated that it is no longer permitted to build a house with wooden door handles. Door knobs have to be solid and round; hollow door knobs can be squeezed by black bears, and levers can be pushed down so that the door can be easily opened by black bears. Physical dividers are also sometimes used to manage human-black bear interactions. For instance, one in-the-field-wildlife manager experiments with putting a perimeter around an entire camp ground located in prime bear habitat, with electric fence to anticipate any – food conditioned – black bear attacks.

The importance of disciplining humans in managing human-black bear interactions is stressed by the following statements of, respectively, an in-the-field-wildlife manager and a policymaker in a town discussing the introduction of a trash directive:

> *"The really important part of nuisance bear management is getting the public to understand that their actions impact bear behavior and ultimately what they do will result in the well-being of individual bears. We [wildlife managers] oversee populations of bears and so we can oversee and manage bear populations very well, but we need the public involved in doing things that will help us keep bears out of town and out of trouble. It's not that the community doesn't value their wildlife, they're just not having been convinced it's their role to secure their trash to protect their wildlife."*

Currently, according to the above descriptions, policy directives on the Colorado Front Range are focused on either disciplining the problematic black bears or on disciplining residents. According to several in-the-field-wildlife managers, residents, and researchers as well as policymakers, black bear management is more about people than about black bears. However, in practice a variety of management strategies emerge, especially in avoiding giving a bear a first strike. As a researcher points out: *"Black bear management is a mixture of social science and wildlife science that are in play here [at the Front Range]"*. The management strategies

employed often focus on the relation between human and black bear, on the interaction that occurred and how to align them. These management strategies of alignment address individual black bears and individual humans, and aim at both human and bear safety. Aligning black bears and humans is achieved by disciplining them simultaneously. In other words, the aim is to bring about mutual adjustments, thereby centralizing the relationship between human and black bear.

5.5 Discussion

The first case described above demonstrated that managing human-wild boar interactions at the Veluwe employs management strategies of confinement. These strategies involve humans dominating wild boars by drawing and maintaining rigid boundaries (spatial, numerical, categorical) and by regulating wild boar movements through reducing population size or through the use of physical dividers in the landscape. In contrast, managing human-black bear interactions on the Front Range rests on the employment of management strategies of alignment, with, at its core, the relation between human and black bear and their mutual adjustments to local circumstances. Consequently, managing human-wild boar interactions at the Veluwe results in spatial separation between the two and thus moves away from the principle of coexistence according to which human and wild animal would be expected to co-construct the space in which both dwell. In contrast, while in managing human-black bear interactions the interactions between humans and wild animals are centralized with the aim to create mutual understanding and co-shaping of their environment.

However, the case of black bear management on the Front Range reveals that the 2-strike policy is still aimed at acting upon black bears when black bears don't learn from their mistakes and continue to transgress particular human-set boundaries. In addition to managing black bears, the emergence of trash directives in Colorado towns are representative of the need to manage and educate humans as well as the bears in order to achieve coexistence. In local practices, black bear management is even more promising than management directives suggest in their aim for coexistence. In practice, in-the-field-wildlife managers intend to avoid implementation of the 2-strike directive by gathering detailed information about the 'problematic' interactions, such as what boundaries have been crossed and how by either black bear or human, and simultaneously seeking for the best possible solution for both human and black bear.

In contrast, in wild boar management at the Veluwe static – policy driven – boundaries, mainly physical and numerical boundaries, guide practice. Populations rather than individual wild boars are managed according to these regulations. Traces

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of alignment between human and wild boar can, however, be found in local practices. Although the relationship between human and wild boar can at best be described as one of domination, building on the detailed knowledge about (individual) wild boar behavior collected by in-the-field-wildlife managers in the process of carrying out their duties may eventually result in thinking in terms of strategies of alignment and in an attempt to co-exist with these wild animals.

Retaining the idea of separating humans from wild animals as much as possible to reduce conflicts between them is untenable in this era of declining wildlife territories and human population growth. In addition, wildlife protection programs around the world are doing so well, that many wildlife populations are booming (Von Drehle, 2013). This means that the need for (alternative) human-wild animal management strategies is urgent. A continued focus on either humans or animals doesn't lead to ideas about how to live together. As the cases illustrated, management can easily slide back to strategies of confinement and disciplining human or wild animal when policy, research or in-the-field management remain focused on either one of them (Palmer, 2001; Rinfret, 2009). When approaching the issue of managing human-wild animal interactions as a collective undertaking in which both humans and wild animals have a 'voice', not in the sense of treating humans and animals as equals, but rather treating both as active participants in interaction, alignment seems to be possible and capable of generating solutions for dealing with current human-wildlife issues. This is not meant to suggest that strategies of confinement are undesirable or unnecessary. In fact, particular spatial boundaries may be necessary to safeguard human and/or wild animal safety. For instance, it might be necessary to protect wildlife territories where cultivation could otherwise result in the disappearance of resources wildlife might need for their survival.

To propagate management strategies that make use of flexible, dynamic boundaries in their aim for coexistence, both detailed knowledge about animal as well as human behavior, and their interactions is needed. This requires integrated knowledge drawn from both the natural sciences and the social sciences. It also calls for further exploration of what Lorimer (2005) calls a 'multi-sensual approach', since humans and wild animals have different preferences in using their senses. Gaining detailed knowledge about the use of the senses in humans and wild animals contributes to mutual understanding and subsequently to the creation of strategies of alignment. Thereby the treatment of these animals as fellow-participants is key to a deeper understanding of the processes of power taking place between human and wild animal (Urbanik, 2012).

Despite the differences in applied management strategies in the two cases, both practices demonstrate that the respective animals are seen as intelligent animals. In the case of current wild boar management in particular this raises several ethical questions, such as how to justify culling wild boars and making use of their intelligence to attract them and subsequently cull them? A continued and strict focus on numbers justified by implementing policy, does not obscure these questions. But when coexistence is aimed at, especially by means of managing interactions between humans and wild animals, these kinds of ethical questions are important to answer. To paraphrase Bradshaw (2009, p. 235) concerning the management of wild boars at the Veluwe: The end product serves not to prevent and disentangle human-wildlife conflicts, but predetermined policy. In the case of black bear management on the Colorado Front Range, these kinds of ethical questions are indeed questioned by in-the-field-wildlife managers. Especially in the implementation of the 2-strike directive. They argue about the justification of killing 'problematic' black bears after 2 strikes when the cause of conflict was human induced (e.g. leaving out food attractants). In-the-field-wildlife managers tend to deal with these questions by attempting to avoid implementation of the 2-strike directive, instead disciplining both humans and black bears simultaneously when a particular boundary has been crossed.

Finally, both of the described wildlife management practices make use of disciplining wild animals. Disciplining wild animals is ambiguous. Or better phrased, when wild animals are disciplined, the line between domesticated and wild animals is blurred (Bradshaw, 2009; Swart & Keulartz, 2011). In aiming for coexistence and applying management strategies of alignment like disciplining wild animals, this sensitive line between domestic and wild animals is put under pressure. Cassidy and Mills (2012, p. 506) clearly describe what is at stake when wild animals enter so-called human spaces by stating *"the confusion over what to call an animal that roams across spaces humans imagine to be limited to themselves"*. Additionally, processes of power between individual humans and animals or groups, also depend on the place of a relation (Urbanik, 2012). Finally, in this debate about the ambiguous use of 'wild' animals, it might also be questioned if 'wild' has solely become a strategic site in environmental politics (Whatmore & Thorne, 1998). Whatmore and Thorne (1998) argue that the 'wild' is in fact surrounding us and not restricted and spatially confined to such strategic places as wildlife sanctuaries, nature reserves and other forms of areal separation. However, the designation 'wild' is still necessary to wildlife management practices since it requires characterizations of wildlife such as species distribution, species density and species abundance in the service of achieving its goals, for instance, the protection of the wild animals in question.

Concluding, as discussed by Lulka (2004), not only wild animals and humans move, boundaries move as well. Both cases have involved a variety of boundaries, and both revealed that, in practice these boundaries are dynamic and become blurred. To manage human-wildlife conflicts and aim for coexistence detailed knowledge about what and how boundaries are drawn in these local practices is needed, since, as the cases have shown, examining the boundaries drawn in policy directives alone does not suffice. In fact, the cases indicated that in managing human-wildlife interactions flexible, dynamic boundaries are a prerequisite to come to solutions. Additionally, in managing human-wildlife conflicts as relational endeavors, particularly strategies of alignment are essential. But, for humans and wild animals to coexist, both strategies of confinement and alignment seem to be required.
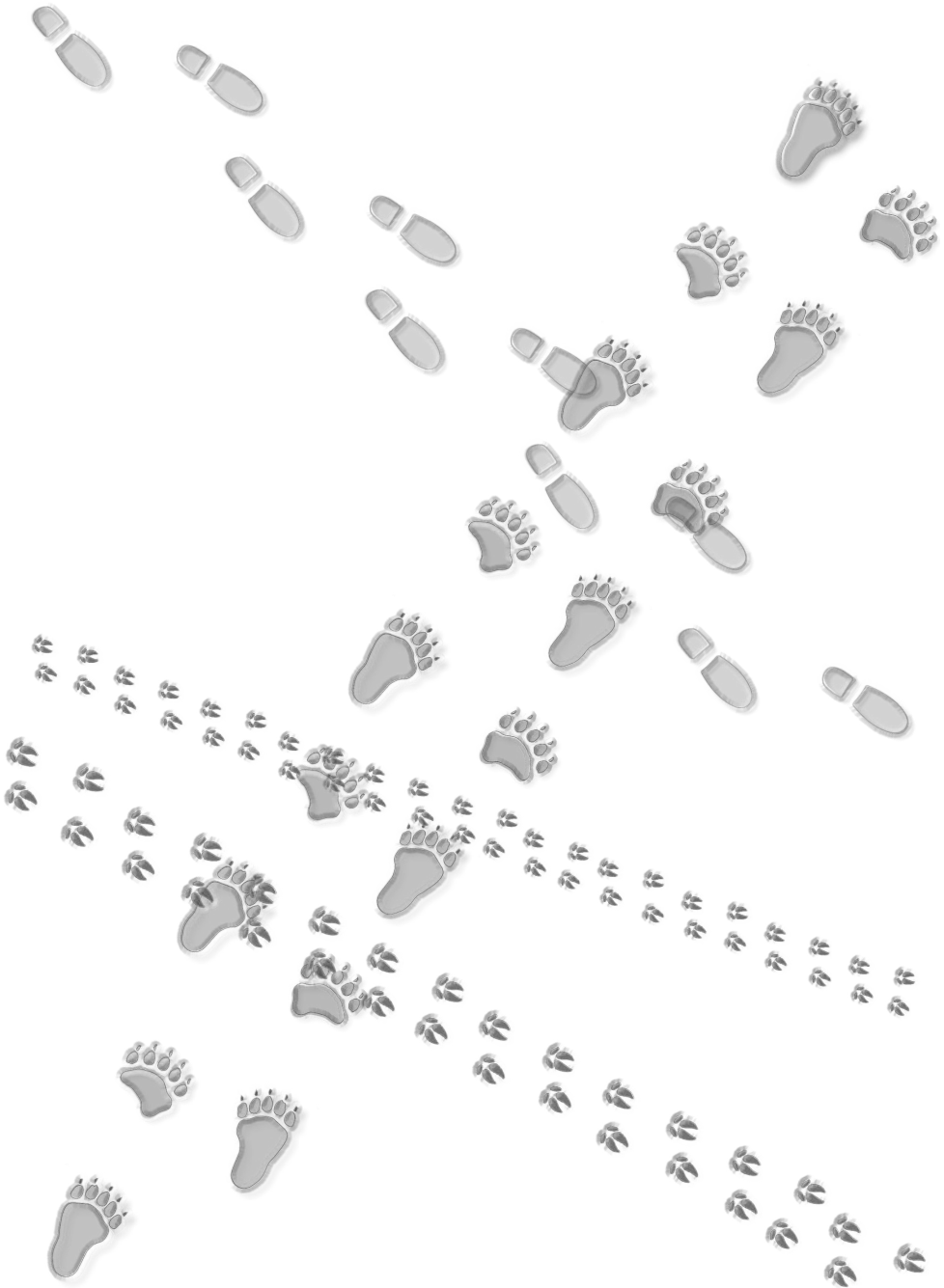
Chapter 6

Towards Cohabitation:
Conclusions and discussion

Towards Cohabitation: Conclusions and discussion

6.1 Introduction

This thesis investigated the management of human-wildlife conflicts in order to identify and understand key elements of cohabitation between humans and wild animals. As explained in Chapter 1, the need for such an investigation arose from the ongoing worldwide increase in conflicts between humans and wild animals. In particular, this thesis addressed the difficulties encountered in managing such conflicts in practice. As has been explicated in the introduction, to explore and understand cohabitation between humans and wild animals requires an in-depth understanding of the complex of activities engaged in by humans, wild animals and landscapes. This thesis has approached wildlife management as a practice that should highlight the interactions between humans and wild animals; its intention has been to approach humans and wild animals more symmetrically when attempting to understand human-wildlife conflicts and their management. On that basis, this research intends to further understand both the differences and similarities between humans and wild animals (cf. Hinchliffe, 2007). Accordingly, the following research questions were posed to guide this research:

How can wildlife management practices achieve cohabitation between humans and wild animals?

1. What is the role of space, data and categories in wildlife management?
2. Which cohabitation strategies can be identified in wildlife management practices?
3. In what ways do the acquired insights contribute to a better understanding of managing human-wildlife interactions?

This chapter presents the conclusions of my research and discusses achieving cohabitation between humans and wild animals. The discussion comprises a theoretical and methodological reflection on the contributions of the research, as well as recommendations for further research, policy, and wildlife management in general. First, this chapter answers the sub research questions by drawing on the findings from the previous chapters (6.2). Second, the general research question is answered alongside a discussion of the concept of cohabitation (6.3). This discussion is followed by an examination of the employed interpretive multispecies research approach (6.4). The final section offers a discussion of the position of wild animals in wildlife management and discusses how this position can be advanced (6.5).

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6.2 Rethinking wildlife management

6.2.1 The role of space, data and categories in wildlife management.

Wildlife management and its concomitant wildlife management strategies make use of particular spaces, data and categories in order to manage and anticipate human-wildlife conflicts. These spaces, data and categories assist in defining and organizing the involved humans, wild animals and landscapes, and they contribute to the design of management strategies. They justify management decisions regarding particular species, groups and individual wild animals and contribute to decisions concerning management priorities, e.g., protection, control, or eradication. Additionally, they make it possible to measure and evaluate the employed management strategies. Ultimately, spaces and data inform the categorization of wild animals. Categorization, in turn, determines management: for example, what constitutes a conflict situation and what represents the negative impact of a particular wild animal? The findings (see Chapter 2) have shown that in wildlife management, these spaces, data and categories are presented as clear and unambiguous and that they are taken for granted. However, this form of wildlife management leads to mixed results and comes with two important and related considerations.

First, wildlife management often refers to domain-specific spaces, data and categories. These involve, for instance, ecological spaces (e.g., habitat preferences of particular species) and social-political spaces (e.g., country borders, management district borders, and national parks), species-specific ecological and ethological data (e.g., numbers and population sizes), and social, ecological and economic impact assessments, as well as domain-specific categories that specify what is considered an invasive wild animal (e.g., based on particular ideas about an animal's origin, behavior and impact), or what is considered a human-wildlife conflict situation. However, the boundaries of these domain-specific spaces, data, categories often do not coincide. For instance, the boundaries of species-specific habitats often do not match the socio-political spaces that delineate where management is required. As a result, wildlife management necessitates the creation of other spaces. These spaces are often defined by the employed management strategies, such as hunting or no-hunting zones. Additionally, the data used to define wildlife management strategies are often universal and species generic, data that treat animals as objects. In fact, in practice, different management strategies might be employed determined by where a particular wild animal dwells (see Chapter 2). This approach requires detailed and continuous data on individuals and groups of wild animal occurrences, behaviors and movements. Furthermore, the data that is required to manage conflicts between humans and wildlife involve a combination of data regarding the respective wild

animals, as well as data concerning the humans involved. These multiple data and multiple conceptions of space result in categories that are not straightforward or previously known but are dynamic, situated constructions of human-wildlife interactions. This brings us to the next consideration.

Second, the use and reliance on fixed and pre-determined spaces, data and categories in wildlife management renders human-wildlife interactions as fully knowable and controllable. Examples include the focus on clearly delineated zero-tolerance areas for wild boars and the determination of numbers of wild boars to be culled in wild boar management as discussed in Chapter 4. However, in practice, human-wildlife interactions are contingent, depending on a combination of local characteristics of the landscape, the characteristics, behavior and number of individual wild animals, and the characteristics, behavior and number of individual humans involved. Consequently, managing these interactions requires dynamic and situated management strategies. The findings from Chapters 3, 4, and 5 have shown that the spaces, data and categories that wildlife managers deploy in practice actually emerge from human-wild animal-landscape interactions. Revealing these spaces, data and categories necessitates an in-depth understanding of ongoing human-wildlife interactions, about how, which, when and by whom boundaries are constituted to identify and define wildlife management strategies. Such a dynamic understanding contributes to furthering our comprehension and pursuit of cohabitation between humans and wild animals. Accordingly, the necessary approach to wildlife management must be one in which the processes and relations between humans, wild animals, and the landscapes where they roam is emphasized. This will, in turn, result in a redefinition of the respective spaces, data and categories employed when making management decisions.

The term 'wildlife management' must also be reviewed in light of the above discussion. Based on this research, not only wildlife, but humans also need to be managed in order to reconfigure the interactions between them (see Chapter 3). Additionally, human-wildlife interactions contribute to shaping the landscape in which they dwell (see Chapters 3 and 4). Based on the findings, it is clearly the sum of the interactions between humans, wild animals and landscapes that requires management in order to anticipate, control, and address conflicts between them. In fact, the word 'management' is, in light of the previous discussions about cohabitation, in itself inappropriate. This term implies that something needs to be managed, something needs to be controlled; recognition of human-wild animal interactions in which the wild animal is a 'participant' alongside humans in a particular landscape, points instead to a concept of management that reconsiders the idea of control and encourages strategies of 'let live' in its place. Such strategies are,

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of course, inherently human interventions. However, wild animals influence, through their 'doings', what, how, which and where strategies might be employed. In that way, these animals can be considered co-participants in defining cohabitation strategies.

6.2.2 The cohabitation strategies that have been identified in wildlife management practices

Based on the findings of the two cases, I have identified five cohabitation strategies. These cohabitation strategies are not currently recognized as deliberate strategies in terms of formal wildlife management but remain largely unnoticed and underappreciated. Still, the findings have revealed that these cohabitation strategies, or at least traces of them, can be found in actual field practices. In fact, in practice, wildlife managers often engage in a balancing act, juggling operative, generic management strategies and the particularities of human-wild animal-landscape interactions requiring management. The findings have shown that wildlife managers regularly search for creative ways to manage these interactions, attempting to stay within the boundaries of formal policy while seeking strategies that will produce the best possible solution for both humans and wild animals (see, e.g., Chapters 3 and 5). At times, this even involved avoiding the implementation of particular formally prescribed strategies. The cohabitation strategies I have identified are a combination of strategies that have some formal recognition but are not commonly implemented or are only implemented alongside more generic management strategies aimed at separation of humans and wild animals or include the more creative strategies employed in the respective field practices. Despite the fact that cohabitation strategies have been identified in practice, the cases of human-black bear and human-wild boar management have shown that human-wild animal cohabitation is far from having been achieved. The employed wildlife management strategies were in fact more typically designed to separate humans and wild animals as much as possible rather than to promote *co*-habitation.

Each of the identified cohabitation strategies is comprised of sets of actions aimed at allowing humans and wild animals to live together in a particular landscape. The interactions between humans, wild animals and landscapes are key to these cohabitation strategies. Additionally, the design and implementation of cohabitation strategies requires an understanding of multi-sensory communication between humans and wild animals (see Chapter 3). The senses addressed in these strategies are specified according to the involved human(s), wild animal(s), and on the basis of local characteristics of the landscape where the interactions (are most likely to) occur. Another key element of cohabitation strategies pertains to the ongoing

processes of learning, remembering and adaptation through varied and repeated encounters. This underlines the necessity for detailed understanding of the doings in human-wild animal interactions. Each identified cohabitation strategy is founded on these characteristics, though each differs in the degree to which particular characteristics are foregrounded. The five cohabitation strategies, although not exhaustive and sometimes overlapping, are the following: zoning, human-wild animal learning, regulation, joint usage, and letting go.

Zoning is a cohabitation strategy that is spatially defined. Different zones are designated on the basis of wild animal, human, or human-wild animal predominance. Each zone involves different management activities. Zones where the wild animals in question may roam 'freely', or in other words are 'safeguarded', remain unmanaged. Zones where humans are 'safeguarded' require a combination of multi-sensory communication to demarcate the zone alongside intense control of any wild animals that threaten human safety. Intermediary zones, where frequent interactions between humans and wild animals occur, require mediation of these interactions through the use of context-specific management activities (adjusted to the involved individuals or groups of humans, wild animals and the particularities of the local landscape). These management activities might involve the design of cohabitation tools (see also '*joint usage*' below) and/or a redesign of the landscape. Thus, these zones, with concomitant management activities, shift emphasis from the wild animal to the human or, in the service of cohabitation, to human-wild animal interactions. These zones are not rigidly bounded or fixed on a map and are maintained accordingly (as in the case of zero-tolerance areas in wild boar management, see Chapters 4 and 5). Instead, these zones are employed in practice and have fluid boundaries that may change according to changes in the interactions between humans, wild animals, and landscapes.

Human-wild animal learning is a cohabitation strategy that emphasizes the mutual learning process between humans and wild animals. This strategy is not confined to particular areas but instead targets particular human-wild animal interactions. This cohabitation strategy employs multi-sensory communication that focusses on repelling, tolerating, or attracting the involved human or wild animal in a particular setting. In essence, this strategy is used temporarily. Some examples include discouraging black bears from entering a home by placing an 'unwelcome mat' (see Chapter 3), attracting wild boars to another area through the use of bait (see Chapter 4), and tolerating black bears in human surroundings, influenced by the distribution of flyers to humans on how to live with black bears (see Chapters 3 and 5).

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Regulation is a cohabitation strategy that is policy-oriented. This regulation strategy is not specified for individual humans or wild animals but is generally aimed at promoting cohabitation between humans and wild animals in particular areas by means of regulations incorporated into policy documents. These policies, or particular changes to existing policies, are the result of learning from mutual encounters. Such regulations are not restricted to wildlife policy but may be interwoven with other fields that are associated with the goal of establishing cohabitation between humans and wild animals. Examples of this strategy include construction policy in the form of building codes that defines how buildings should be designed in order to prevent wild animals from entering these spaces and trash directives that define trash storage, deposit, and haul times, as well as fines when trash regulations are not met (see Chapters 3 and 5).

Joint usage is a cohabitation strategy that takes advantage of and anticipates a common interest of both human and wild animal. As such, this strategy anticipates possible conflict situations through a focus on developing particular cohabitation tools. 'Joint usage' differs from 'human-wild animal learning' in its focus on particular areas that are shared by humans and wild animals without the intention to displace either from that area. And, this strategy differs from 'regulation' as a cohabitation strategy by its focus on a joint interest that is translated into a particular cohabitation tool involving mutual learning, rather than policy regulations alone. Key to this cohabitation strategy is the identification of the common interest for wild animal and human in order to determine the cause of (frequent) conflicts. Trash in the case of human-black bear interactions, is a good example (see Chapters 3 and 5). To reveal such a joint interest necessitates intimate, affective and multi-sensory knowledge about the respective human-wild animal interactions. Once the joint usage is determined, this knowledge contributes to discerning how both humans and wild animals are connected with or attracted to that particular interest. That knowledge contributes to and is translated into a particular cohabitation tool, such as the bear resistant trash can (see Chapters 3 and 5). Ultimately, the resulting cohabitation tool contributes to humans and wild animals sharing the same space without conflict.

Letting go is a cohabitation strategy that is based on the assumption that humans and wild animals will find a way to cohabitate without the need for active management. This strategy is also based on the presumption of mutual learning abilities between humans and wild animals. It is a strategy that is not widely implemented but is sometimes unofficially experimented with in local practices, based on the experience of local wildlife managers. This strategy entails

relinquishing control, frequent surveillance, and requires action only when situations threatening humans occur or if wildlife safety is of life threatening concern.

The identified cohabitation strategies in this research clearly indicate the importance of mutual adjustments on the part of both humans and wild animals as they learn to live together and actively co-shape landscapes of cohabitation.

6.2.3 The ways in which the acquired insights contribute to a better understanding of managing human-wildlife interactions

Managing human-wildlife interactions by controlling wild animals and separating them from humans is no longer tenable in those situations where humans and wild animals increasingly invade each other's space in their search for – limited – resources such as food and shelter. Concurrently, management based solely on models and quantitative data has been proven a too simple approach in managing human-wild animal interactions and is often contested. This research has generated four important insights that contribute to a better understanding of the management of human-wildlife interactions: *mutuality* between humans and wild animals; processes of *affective learning* between humans and wild animals; *differences* between humans and wild animals; and *mindedness* of individuals and collectives.

A focus on *mutuality* in managing human-wild animal interactions shifts focus from either managing humans or managing wild animals to managing their interactions. Mutuality emphasizes the intimately entangled back-and-forth character of these interactions, as has been shown in both empirical cases (Chapters 3 and 4). This insight suggests that both human and wild animal behavior need to be taken into account in co-constructing their interactions. Thereby, mutuality promotes a more detailed understanding of human-wildlife interactions, which is enabled by examining the actions, multi-sensory processes, as well as the mutual learning occurring in the practice of managing human-wildlife interactions. Gaining such detailed, contextualized, knowledge about human-wild animal-landscape relationships leads to management strategies that entail the mutual adjustment of humans and wild animals to local circumstances (cf. 'strategies of alignment' in Chapter 5). As a result of focusing on mutuality in managing human-wildlife interactions, wild animals are approached as beings that we need to learn to live with.

Affective learning between humans and wild animals has been shown to be essential in getting to know and managing human-wild animal interactions (see Chapter 4 on counting and hunting wild boars). This insight draws attention to the subjective experiences of human-wild animal interactions through highlighting the bodily skills and tuning in to the multiple senses and sensitivities that go into these

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interactions (see Chapters 3 and 4). In other words, attention to affective learning places the importance on non-standardized ways of knowing in managing human-wild animal interactions. Furthermore, processes of affective learning also point to the continually evolving processes of adapting, learning, and remembering between humans, wild animals and the ever-changing complex landscapes in which they roam. Affective learning makes it possible to generate a mutual understanding between humans and wild animals and to generate new ways for managing their interactions (see Chapters 3 and 4).

The previous two insights for managing human-wildlife interactions emphasize the need to explore human-wild animal interactions. Exploring these interactions involves becoming close to the wild animals to generate the mutual processes described above. However, through these in-depth examinations, *differences* between humans and wild animals become more prominent. This seems paradoxical: while getting close, differences grow[1]. However, by revealing and highlighting these differences (as well as similarities), I have shown that they inform our understanding of invading and often unruly wild animals in human surroundings and have informed the management of their interactions (see Chapters 3 and 5). For instance, detailed knowledge about the use of senses by humans and wild animals contributes to a mutual understanding and deployment of particular management strategies (see Chapters 3, 4 and 5). Furthermore, highlighting differences in managing human-wild animal interactions also points to differences between individuals (human and wild animal), differences between groups (human and wild animal), and differences between landscapes. As such, to manage human-wild animal interactions requires a dynamic appreciation of the differences between humans and wild animals and between areas; human-wild animal interactions differ depending on location.

Finally, an acknowledgement of *mindedness* in managing human-wildlife interactions points to the dynamic processes of shared learning, mutual adaptation and remembering between humans and wild animals (see Chapter 4 for more information on mindedness). Specifically, an understanding of mindedness recognizes wild animals as intelligent, sentient beings that actively relate to particular landscapes and that are able to learn as *individuals* and as *collectives* (see Chapter 4). This recognition highlights both the importance of a relational focus in

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[1] This paradox has also been recognized by Hinchliffe (2007). The statement is important in the service of pursuing cohabitation between humans and wild animals. A growing awareness and recognition of differences would not necessarily result in a separation of humans and wild animals. In fact, it can contribute to finding ways for them to live together.

managing human-wildlife interactions, and it implies an awareness that wild animals – as individuals or groups – may respond differently to and participate differently in management interventions. The latter refers to an important consideration in managing human-wildlife interactions, in that the effectiveness of wildlife management strategies may vary in different areas and, as a result, that managing human-wild animal-landscape interactions requires a variety of management strategies that are flexible and open to adaptation.

These four insights in understanding managing human-wildlife interactions contribute to pursuing cohabitation between humans and wild animals, as will be further discussed in the next section. As such, that section also provides an answer to the main research question of this research.

6.3 Towards cohabitation between humans and wild animals

In this section, I first re-visit the current human-wildlife challenge in the aim for cohabitation between humans and wild animals, both as a theoretical undertaking and in wildlife management practices, in light of my research findings. The section proceeds by providing an outlook on how to move forward towards cohabitation between humans and wild animals.

Anticipating and managing human-wildlife conflict situations has commonly been addressed by wildlife management that attributes otherness to wild animals and separates humans from wild animals (Lulka, 2004). Such management results in employing management strategies involving systematic and intense control of wild animals (e.g., by employing population management or numerical management practices) or in creating additional or enlarged detached and distinct spaces specifically for wild animals versus humans. This approach to management is untenable in the face of increasing competition over space (by humans and wild animals), as human populations expand and wildlife habitats continue to shrink. Furthermore, such an approach continues to adhere to management strategies that focus on finding universal and fixed solutions for conflict situations between humans and wild animals. As shown in this research, the taken-for-granted acceptance of particular categories when establishing management strategies and the persistence of management based on rigid boundaries and universal assumptions are problematic in the practice of managing human-wildlife interactions. This has been made clear by the two empirical cases presented in this thesis. Instead, wildlife management aiming for cohabitation between humans and wild animals should shift its perspective from 'acting upon' – prevalent in Western wildlife management practices – to 'acting with' wild animals. 'Acting with' requires various changes in

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re-arranging these management practices. These changes involve examining and emphasizing the *interactions* between humans and the respective wild animal and the concomitant dynamic nature of human-wildlife conflicts. Management, then, is focused on managing these interactions without falling back on mere disciplining of either humans or wild animals. It also involves dynamic, rather than rigid, constructions of the spaces, data and categories that assist in the employment of the cohabitation strategies required to enable cohabitation. Such a dynamic approach is accompanied by the idea that boundaries are constructed in interaction, by the involved humans and wild animals. The multinatural approach outlined in Chapter 4 offers such a dynamic approach. This approach entails that management acknowledges and draws on the multinatural processes and interactions in these practices: mutuality, affective learning, differences between humans and wild animals, and mindedness of individuals and collectives. Such a multinatural approach to wildlife management reveals possible co-dependencies, differences and similarities between humans and wild animals and provides opportunities to think along with the respective wild animals (Bear & Eden, 2011; Hurn, 2012).

This multinatural approach to managing human-wild animal interactions uses a combination of social science and natural science research to understand and possibly modify the behavior of humans and wild animals in specific contexts and in human-wildlife conflict situations in general. Specifically, employing the acquired detailed (affective) knowledge about human-wild animal-landscape interactions in practice provides clues concerning how it might be possible to modify the respective interactions in order to anticipate and prevent conflicts. This approach also implies that management is flexible and open to adaptation because the movements of humans and/or wild animals can change as a result of landscape changes (e.g., human development in areas formerly designated as wildlife habitat) as well as changes resulting from climatic events, including both seasonal and global changes. Finally, a multinatural approach to managing human-wild animal interactions does not only contextualize those interactions and specifies them according to where they occur. This approach also takes account of the landscape that co-shapes and is co-shaped by the respective interactions (Barua, 2014c; Lorimer, 2010a). Furthermore, a multinatural approach provides a way to foreground wild animals as participants, as humans already are, in the – to be – managed human-wildlife interactions. In summary, the proposed cohabitation between humans and wild animals and the application of accompanying cohabitation strategies entail a multinatural approach to managing human-wild animal-landscape interactions. Wild animals are considered to be co-constitutive participants in the management of these interactions.

This conception of cohabitation contributes to the debates around a multinatural understanding of wildlife management practices (Latour, 2004b; Lorimer, 2012), to debates about 'living with' (Hinchliffe et al., 2005; Turnhout et at., 2013), to broader ideas of convivial conservation practices (Hinchliffe & Whatmore, 2006; Kpéra et al., 2014), and to how to translate the outlined ideas of cohabitation to the (complexity of) wildlife management practices. Particularly, wildlife management practices with regard to wildlife conservation, landscape restoration, and protected area management, both globally and locally, experience difficulty in finding ways for humans and wild animals to live together (Knight, 2000b; Madden, 2004; McKiernan & Instone, 2016; Skogen et al., 2008). On the one hand, remarkable recoveries, such as those of bears, wolves, lynx, and beavers (Boitani et al., 2015; Deinet et al., 2013) have been achieved as a result of the application of particular conservation programs (Environment Directorate-General, 2007). On the other hand, these recoveries have resulted in an increase in human-wild animal conflict situations in which these (recovered) animals engage in their search for – limited – resources (e.g., food and shelter). These situations occur, at least in part, because protected areas and wildlife refuges have increasingly become islands in the middle of human-dominated landscapes. As a result, the respective wild animals become increasingly seen as pests, invasives, and are generally disliked in these human-dominated landscapes (Hiedanpää & Pellikka, 2017; Knight, 2000b; McKiernan & Instone, 2016). The consequences of such categorizations have been discussed in this thesis. Since attention to cohabitation is increasing in scholarly literature and in wildlife management practices, I will end this section by outlining three ways to move towards cohabitation between humans and wild animals. These moves can be seen as a point of departure to think about and proceed towards cohabitation in wildlife management.

The first way to move towards cohabitation is to generate so-called micro-geographies of multispecies cohabitation. These are fine-scale and temporal areas where humans and wild animals have found a way to live together without the need for full dominance. They are fine-scale in that these micro-geographies of cohabitation are adapted to the local characteristics of the human-wild animal-landscape interactions. Additionally, they are temporal because human-wild animal-landscape interactions might change over time, which might result in, for instance, changes in spatial requirements (Collard, 2012; Vetter et al., 2015). As such, micro-geographies of multispecies cohabitation remain open and are able to adapt to such changes, as well as other changes in the surroundings that impact the respective interactions. Examples of such changes are changes in landscape composition (e.g., increase in buildings, forest decline or increase, and agricultural variations), climatic

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changes (e.g., flooding, extreme droughts, and severe winters), and an increase in human access to an area (e.g., increase in tourism or game hunting). Accordingly, these micro-geographies of cohabitation include dynamic, flexible boundaries. For instance, instead of using conventional and definite fences, wildlife management might make use of, for example, particular landscape features such as hedgerows or water pools that might assist in guiding the movements of particular species or repelling them from a particular area; guardian dogs could be deployed to protect (free-roaming) livestock against wolf predation (Smith et al., 2000; Van Bommel & Johnson, 2012); or temporary fences could be deployed, such as fladry barriers, to teach wild animals to stay away from livestock (Musiani et al., 2003). In some cases, however, this may require more rigid spatial boundaries. These cases involve situations where human and/or wild animal safety is severely at risk, such as in the case of safeguarding particular wildlife resource areas in order to prevent cultivation, resulting in the disappearance of the wild animals living there. Referring to Jones (2009, p. 8), the generation of micro-geographies of multispecies cohabitation is dynamic and consists of: "*an ongoing renegotiating of boundaries*". Key to the generation of such micro-geographies of multispecies cohabitation is both centralizing the human-wild animal-landscape interactions and giving precedence over wild animal(s) (e.g., wolves, deer, wild boars, and bears may be given precedence in turn). The latter is important, because in the generation of micro-geographies of cohabitation, guiding cohabitation strategies might be required, which are based on detailed understanding of the doings in human-wild animal interactions, and are thus based on animal specific characteristics (see section 6.2.2). Centralizing human-wild animal-landscape interactions in the generation of these micro-geographies of cohabitation, in practice as well as in policy, is important because in doing so, both humans and wild animals are taken into account as 'participants' in decisions regarding which strategies to employ to generate cohabitation between them. Wildlife management that moves towards the creation of such micro-geographies of multispecies cohabitation can be seen as a hybrid middle ground in between management of 'full control' (human-dominance) and management of 'let go' (no management). This move is associated with the idea of "*gradualization*" (Keulartz, 2009, p. 36), which involves thinking in terms of degrees of cohabitation instead of employing rigid boundaries to overcome fierce opposition in human-wildlife conflict management (cf. Thompson, 2002). In conclusion, micro-geographies of multispecies cohabitation can be achieved through the employment of a variety of cohabitation strategies. And, ultimately, these micro-geographies of multispecies cohabitation can be seen as fine-scale solutions to human-wildlife conflicts and may be a promising way to overcome human-wildlife challenges in the future (Carter & Charles, 2011; McKiernan & Instone, 2016, this thesis).

A second move in the direction of cohabitation between humans and wild animals refers to combining formal ways of knowing with informal, non-standardized, non-representational ways of knowing (see also Chapter 4). In this context, the more formal, standardized, and verifiable ways of knowing and data collection, such as the use of camera traps and GPS tracking to acquire insight into spatial movements, might be combined with affective and multi-sensory knowledge concerning the movements and activities of the respective wild animals and humans in a particular landscape. Together, these forms of knowing contribute to the development and legitimation of cohabitation strategies. Thereby, formal ways of knowing and related static notions of wild animals and landscapes, such as numbers and generic categorizations, are not produced and used for universal, standardized strategies in wildlife management. Instead, they contribute to gaining more insight into and modifying human-wild animal interactions and contribute to the design of new cohabitation strategies, in addition to informal ways of knowing. Although recognizing and acknowledging informal ways of knowing are relatively new in current-day – generally Western – wildlife management with regard to pursuing cohabitation, they are key and prevalent in the practices of hunter-gatherers (Hurn, 2012; Ingold & Kurttila, 2000). These hunter-gatherers, in their interactions with wild animals, recognize that individuals and collectives of wild animals have complex social lives, with their own particular histories, needs and desires, similar to, but different from, humans (Hurn, 2012; Ingold & Kurttila, 2000). This thesis has suggested that such ways of knowing are largely hidden in wildlife management practices. To pursue cohabitation between humans and wild animals through a multinatural approach to wildlife management, as suggested in this thesis, also requires these informal ways of knowing, to attune to and to be affected by a variety of species (see Chapter 4 for more detail). This move thus involves establishing prolonged interactions between humans and wild animals, such as these hunter-gatherers accomplish on the basis of collective experience from generations of hunters (Hurn, 2012). One way to collect these field experiences is by collecting management stories that describe the affective account of human-wild animal-landscape interactions. These stories, as has been discussed in Chapter 4, also include the stories generated and experienced by the animals involved (Van Dooren & Rose, 2012). As such, wild animals should thus be seen as co-constituting these 'management' stories. Collecting such stories that involve these other ways of knowing is not restricted to wildlife management practices or hunter-gathering practices. More modern sorts of 'gathering' make use of similar ways of knowing and interacting with wild animals: both nature photography and nature filming also require longitudinal, non-intrusive visits to particular environments. Additionally, scientific field studies on animal behavior increasingly reveal and acknowledge the

importance of subjective experiences, that is, affective learning, in collecting the required data in the field (Bradshaw, 2017; Goodall, 2009; Hurn, 2012; Van Dooren, 2014). These informal ways of knowing are argued to be essential not only to further our understanding of wild animal behavior but also in relation to serving conservation aims and in the exploration of future possibilities to 'live with' these wild creatures (Bradshaw, 2017). As such, to find ways of human and wild animal cohabitation, wildlife managers can share these management stories, which include sharing their experiences concerning experiments with a variety of cohabitation strategies and initiating new experiments. As this thesis has shown, wildlife managers already experiment with a variety of cohabitation strategies. However, at present, they are generally deployed to meet – and maneuver within – the pre-set requirements prescribed by formal management. To consider alternatives for managing human-wildlife conflicts and to find a broadly accepted willingness to release control over nature (see also the third move below), these stories can also be shared among wildlife managers, scientists, residents and policymakers. To share these stories, to reveal and reinforce affective ways of knowing and learning, and to encourage creative thinking about cohabitation strategies, I recommend the initiation of a variety of conversations. Examples of these conversations are between natural scientists and social scientists (Barua & Sinha, 2017; Mason & Hope, 2014), between wildlife managers and volunteers (Carballo-Cárdenas & Tobi, 2016), and between wildlife managers and conservation scientists (Sutherland et al., 2004). In short, these are multidisciplinary and transdisciplinary conversations in which, as discussed above, wild animals are co-participants in the way they respond to and might experience – in whatever way – particular encounters (Van Dooren & Rose, 2012). Thus, combining these ways of knowing, collecting management stories, and initiating the described conversations might provide clues to generate new or adapt existing cohabitation strategies. It might even reveal already existing cohabitation strategies, of which we are not currently aware.

A final, third move towards cohabitation between humans and wild animals, concerns the fact that an open-ended approach to wildlife management requires acknowledging that we – humans – are limited in our capacities to shape space to our will and are not fully able to control the behavior of wild animals. This can be uncomfortable. It requires acknowledging that there is no one universal solution in managing human-wildlife interactions and instead necessitates focusing on the – seemingly – forgotten local nature of interactions between humans and wild animals, as these interactions evolve over time. I suggest that an in-depth understanding of the interactions between humans, wild animals and the landscape, as has been outlined in this research, is needed to reveal the main processes and main causes of

human-wildlife conflicts and to pursue cohabitation between humans and wild animals. To reveal these processes and causes and to employ cohabitation strategies requires continuous monitoring of management activities, possibly by means of the suggested conversations as outlined above. As such, this thesis has contributed to further outlining the notion of 'responsible anthropomorphism' (Johnston, 2008). With this term, Johnston specifically refers to knowing about and knowing with (wild) animals on the basis of *actual* human-animal relationships. And, to this end, as has been undertaken in this thesis, the animal is seriously considered as an active, sentient partner with whom we can communicate (Johnston, 2008). These detailed understandings of actual human-wild animal-landscape interactions make it possible to make more responsible choices in conflicting situations and, as such, contribute to a less anthropocentric approach to wildlife management. This understanding could allow wild animals to engage in their natural behavior, rather than being forced into situations that are predetermined by humans and that severely restrict the wild animal's behavior (e.g., fenced areas and culling practices). In fact, thinking in terms of responsible anthropomorphism and cohabitation between humans and wild animals includes "*learning to care in complex ways*" (Ginn, 2014, p. 541). Indeed, as the findings have shown, even in practices of 'killing', an ethics of care can be present (Candea, 2010; Ginn, 2014; Haraway, 2008; Hurn, 2012). Ginn (2014, p. 541) has described this as "*killing mindfully*". Nevertheless, employing wildlife management strategies of intense control and dominance would be the exception in pursuing cohabitation between humans and wild animals. Achieving cohabitation as outlined in this thesis concerns a mode of management in which the wild animals are included as participants and whereby humans, wild animals and the landscape may be given precedence in turn, while under alternating and experimental ideals of what constitutes 'flourishing' (Haraway, 2008). Accordingly, cohabitation as outlined in this thesis can be placed in between on the one hand a more philosophical account of management, for example, what Haraway (2008) would call human and animal flourishing, that is, the ideal of humans and wild animals living together peacefully. Both humans and wild animals would flourish in such a mutual relationship (Driessen, 2016; Haraway, 2008; Lorimer, 2012). And, on the other hand, a mode of management that is aimed at control, for example, which might be referred to as a biopolitical mode of management. Biopolitics concerns a strategic – human – coordination of the human-wild animal relationship. Its emphasis is on 'acting upon' the wild animals in order to manage them (Chrulew, 2011). Ultimately, such an approach to achieve cohabitation could result in generating a variety of landscapes of cohabitation, in which wild animals are also allowed to become with the landscapes, with fellow animals and with other species in unspecified ways.

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6.4 Multispecies research approach

This section reflects on the interpretive multispecies research approach I have employed, including the multispecies ethnography used, and it reflects on the role of the interpretive researcher as part of this research. The section proceeds by discussing some critical remarks, including the research's interdisciplinary attempt of the methodology used and a discussion of how to move forward by improving this methodology. This section also elucidates the research's contribution in foregrounding animals as part of what I will call a 'multispecies turn' in interpretive research.

I begin with a reflection on the use of the interpretive multispecies research approach in this research. Based on the interpretive perspective of this research, the stated research aim and research questions set out in the introduction, this research followed a qualitative research approach, more specifically, an interpretive multispecies research approach. This approach was considered to be appropriate, since the focus of the research was on human-wildlife conflict management, which involves multiple species that interact and the interpretation of their behaviors. The most important (methodological) challenge of this research was to approach humans and wild animals more symmetrically than is common in studies that address human-wild animal relationships. Therefore, I tied together ethnographic, ethological, and ecological approaches to the interactions between humans and wild animals in the examined wildlife management practices. The use of an interpretive methodology that uses a variety of methods (see, e.g., Haverland & Yanow, 2012) made it possible to combine such a variety of research approaches from ethology and ecology that build on positivist epistemology and ontology with an ethnographic research approach that builds on an interpretive (or constructivist) epistemology and ontology. This has resulted in the employed multispecies ethnography and has generated an understanding of the so-called 'lived experiences' of humans and wild animals in proximity to each other and how their interactions were shaped (Bear, 2011; Buller, 2015; Dempsey, 2010; Hodgetts & Lorimer, 2015). This multispecies approach emphasized understanding the interactive and dynamic processes between humans, wild animals and landscapes through a focus on their doings and activities as they were expressed in words or other signals (visual, olfactory, auditory, and tactile). The combination of in-depth interviews, participant-observations, focus groups, and documentation that I used in this research has had a particular strength in that this combination enabled me to capture the broader scope of wildlife management (policy, in-the-office management, research, and experiences from local residents) and to avoid focusing only on field practices and actual human-wild animal interactions. The participant-observations have been demonstrated to be

highly useful in arriving at a more detailed understanding of these field practices. These participant-observations were particularly useful in revealing multi-sensory and affective learning processes or, broadly speaking, in revealing non-standardized, informal ways of knowing. This methodology contributed to the generation of an affective account of wildlife management (Barua & Sinha, 2017). Collecting this field knowledge and translating it into words, that is into human language, as in the case of affective relationships, has, however, not been easy (Haraway, 2008; Lorimer, 2006a). It was possible to gain a sense of the processes that occurred in the respective wildlife management practices through immersion in the field practices, reading between the lines of written documents and through ongoing processes of (re)interpretation of the various human-wild animal interactions, including the human behaviors (of research participants and researcher) and animal behaviors in these interactions (both individual and group behavior) (Barua & Sinha, 2017; Buller, 2015; Yanow, 2006).

Additionally, a focus on key-incidents (Emerson, 2010) has been essential in revealing seemingly trivial details and unanticipated topics that could otherwise not be retrieved through conducting participant-observations only, such as particularities in the historical background of wildlife management in the areas under investigation. 'Key-incidents' are empirically rich in that they provide an understanding of the complexity of day-to-day human-wildlife conflict management, whether or not these are declared as conflicting human-animal interactions by the humans involved. A focus on key-incidents, in fact, can be regarded as a methodological strength in this research, as well as for future research into the complexity of human-wildlife conflict management. The key-incidents selected as part of this research were selected intuitively in the course of the research. This selection was based on the possibility that they would provide more, and more detailed, data concerning the interactions between humans and wild animals in the respective wildlife management practices (Emerson, 2010). The analysis of these key-incidents concentrated on the various ways in which human(s) and wild animal(s) responded to each other's presence, as well as on the respective actions. The latter included a concentration on the processes of (mutual) decision making observed in the mutual back-and-forth processes occurring between human and wild animal (black bear or wild boar) and/or based on the interpretations of the respective humans involved in those interactions (Buller, 2015). The analysis also included a focus on the management strategies employed to address the respective conflict situations. To generate an interpretation of embodied (field) knowledge of human-wild animal interactions in the respective wildlife management practices, the interpretations of the respondents in combination with the (field) interpretations

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made by the researcher have been correlated with available ethological and ecological knowledge. Ultimately, this resulted in the generation of a variety of management stories about human-wild animal-landscape interactions. To produce these stories, my (affective) learning process, as a researcher, has also been taken into account, which causes me to reflect on my own role in this research.

The outlined interpretive multispecies research approach acknowledges that the researcher – whether consciously or unconsciously – influences the research process. To critically reflect on and illustrate my own identity in relation to my fieldwork, I will relate an anecdote about something which occurred while I was conducting fieldwork on wild boar management. At that time, I was counting wild boars. When counting wild boars, it is very important not to be noticed by them. That means it is necessary to anticipate detection by their most important senses, which are in the case of wild boars their sense of hearing and their sense of smell, rather than their sense of sight. If these – animal-specific – characteristics are not taken into account by the counter, boars will never arrive at the site where they can be counted. One way to remain unnoticed is to dress in dark colors, use no artificial odors, such as perfume, avoid strong smelling sandwich fillings and creaky sandwich bags, and avoid wearing crackling clothes. Additionally, the most important way to avoid notice is to be silent. However, on this occasion, I had an uncontrollable urge to cough. At that particular moment, there was no wild boar in the site before us, but there was a roe deer roaming around. When I coughed, the roe deer's head went up, and its ears became straight and pointed in our direction, after which it moved away. Although we (the wildlife manager and I) did not see a wild boar around, this incident could have affected wild boars that might have been roaming nearby, of which we were not yet aware. Reflecting on such (field) experiences has contributed to becoming better attuned to and engaged with both the wild animals and the humans involved, by means of respecting and adapting to their code of conduct and by immersion in the respective practices. With regard to establishing a mutual understanding with the respondents, and consequently enhancing the production of knowledge, my back ground in ecology proved to be useful in understanding and relating to the disciplinary terminology used. At the same time, I realized that my ecological background affected some of the respondents' expectations about the research I was conducting, which was not ecological research. Reflection on these (field) experiences has not only been useful for becoming acquainted with the investigated field practice. It has also contributed to the generation of more (detailed and affective) knowledge about the experiences, understandings, social worlds, and the responses of the respondents, as well as about the interactions between humans

and wild animals in the field, such as those described in this thesis (Barua & Sinha, 2017; Buller, 2015; Shehata, 2006).

Ultimately, based on the previous reflections, employing an interpretive multispecies research approach has not only proven useful in revealing details taken for granted by the experienced (wildlife) researcher and/or wildlife manager but has also contributed to progress in the multi-sensory and mutual affective understanding of human-wild animal relations, understanding and revealing cohabitation strategies, and understanding wildlife management pursuing cohabitation in general. Consequently, this research has contributed to foregrounding animals in interpretive research methodology through its relational, interdisciplinary, and transdisciplinary approach, as has also been suggested in the work of other researchers (Candea, 2013; Haraway, 2008; Hayward, 2010; Hurn, 2012; Locke, 2017; Roth & Bowen, 1999). The employed interpretive multispecies research approach has also contributed to the attempts by other researchers to consider the wider environment when studying human-animal interactions (Barua, 2014a; Barua & Sinha, 2017; Buller, 2015; Hodgetts & Lorimer, 2015) through incorporating and contextualizing the landscape in these interactions. As such, this approach requires in-depth field work through immersion in the field. The researcher, then, becomes acquainted with the environment, including the wild animal(s) and human(s), allowing them all to get to 'know' each other, as well as the wider landscape in which they interact (see, e.g., Bradshaw, 2009; Smuts, 2009). Accordingly, this research has not merely contributed to furthering a so-called 'animal turn' in interpretive research. Rather, I contend that a more appropriate comment is that it has contributed to a 'multispecies turn'. I believe labelling it as 'animal' is misleading and distracts from its relational and multispecies approach.

Now I will turn to some critical remarks regarding the use of this research approach. The first concerns the research's attempt to symmetrically approach humans and wild animals. Thereby, it is important to understand that we – humans – can never really know what is going on in the mind of another, whether human or animal. Certainly, we never fully get to know the animal (Buller, 2015; Hodgetts & Lorimer, 2015; Hurn, 2012). As a result, an interpretive and relational approach pursues arriving at an understanding of their behavior in so far as possible. The employed participant-observations have contributed to a symmetrical approach to the investigated human-wild animal interactions in that it was the researcher that interpreted these interactions and the concomitant behavior of the humans and wild animals involved. However, because of the research's focus on capturing the broader scope of wildlife management, asymmetry in approaching human-wildlife interactions was introduced, through conducting interviews, focus groups, and

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document analysis. This asymmetry concerns the researcher who interpreted other human interpretations of wild animal behavior, including those from ethological and ecological researchers (Buller, 2015). To further a symmetrical approach to understanding human-wild animal relations, I suggest that participant-observations are most useful. Nevertheless, I argue that more participant-observations than have been conducted in this research are needed to further our understanding of the various multi-sensory and affective learning processes in various human-wild animal interactions, or, broadly speaking, human-nature relations in wildlife management practices. In fact, I suggest that this requires long-term participant-observations in field practices of wildlife management (cf. Hodgetts & Lorimer, 2015). This suggestion relates to my second critical remark.

My second remark concerns the research's attempt at interdisciplinarity. In this research, it was me, as a researcher, who tied together and interpreted the different ethnographic, ethological, and ecological approaches to the human-wild animal interactions in the examined wildlife management practices. This research also consisted of textual analysis of ethological and ecological research and in-depth interviews with more over researchers, being held in offices, instead of in the field where the actual interactions occur. That said, this research could have better addressed the interdisciplinarity it was aiming for through the initiation of conversations, preferably on a regular basis, with ecologists and ethologists ìn the respective field practices, while observing wild animals or participating in their field research. This would have resulted in shared meaning making of human-wild animal interactions while being present in the field practices. I argue that such a combination of the different disciplinary perspectives in the field would add to our understanding of human-wild animal interactions. Another approach, which is also a suggestion for future research, is to initiate interdisciplinary research projects that include such conversations while conducting fieldwork together (Barua & Sinha, 2017; Mason & Hope, 2014). Such an approach is especially relevant in the research field of human-wildlife conflict studies where research interests converge. The interdisciplinary conversations and research projects between, e.g., ethnographers, ethologist and ecologists would involve conducting field work together and reading together, across and around each disciplinary background. Additionally, these research projects would also include transdisciplinary conversations, such as with wildlife managers and volunteers who relate to the respective management practices. This is – again – challenging, but I believe that such experimentation in research approaches contributes to overcoming human-wildlife challenges in the future. Importantly, such experimentation requires employing an open approach to studying humans and wild animals in their wider environment (Bradshaw, 2017; Mason & Hope, 2014,

this thesis). As the result of such an open approach, our prejudices might need to be reassessed. This brings me to the last remark.

A final, third, critical remark, relates to the wider landscape in which the human-wild animal interactions occur. The employed interpretive multispecies research approach has taken the landscape into account, however, 'the landscape' might still be a too broad conception of, moreover, the multiple species that are present in those landscapes and which might influence the human-wild animal interactions under investigation. This is especially the case when we consider recent research that acknowledges that plants are also considered to have the ability to quickly adapt and respond to their wider environment (Gagliano et al., 2016; Hall, 2011). With regard to this research on plants, attention is drawn to the 'sensory apparatuses' of plants, such as auditory responses (Gagliano et al., 2012), odor responses (as described by Hughes, 1990), or more generally, the ability to co-operate with certain insects to defend themselves (for more information and examples see: Palmer et al., 2008; Wohlleben, 2016). Additionally, in the case of wild boars, Welander (2000) argues that some plant species (especially annuals) may have adapted to cope with rooting by wild boars, which occurs every year at approximately the same time, and have learned to take advantage of the resulting increase in nutrient availability and reduced competition. In light of the interdisciplinary conversations I have proposed above, this recent research into 'plant communication' suggests the intriguing idea that the generation of management stories might eventually include so-called 'plant stories', thereby offering a new perspective on the processes of multi-sensory communication occurring in management practices.

Synthesizing my research with the work of other researchers in human-animal studies and recent debates regarding investigating cross-species processes of learning (e.g., Barua, 2014a; Barua & Sinha, 2017; Bradshaw, 2017; Buller, 2015; Hodgetts & Lorimer, 2015; Locke, 2013; Urbanik, 2012), foregrounding animals through the application of an interpretive multispecies research approach is promising. Still, this approach requires further investigation and experimentation as outlined above, especially to promote a multinatural understanding of wildlife management. Therefore, I suggest that further development and experimentation is needed with a research approach that might be perceived as involving 'multispecies ethnologies' (Kirksey & Helmreich, 2010) or 'ethnographies of life', that is, involving an ethnography that concerns the effects of human and animal entanglements with other kinds of living beings (Hurn, 2012; van Dooren & Rose, 2016). I believe the methodological future of studying human-wild animal interactions can be found in the proposed relational multispecies turn in interpretive

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research, in which human-animal researchers are not to be seen as 'flies on the wall' but as active participants, engaging in and attuning to the field practices under investigation.

6.5 Highlighting the 'voices' of wild animals

In this section, I contribute to discussions regarding how to put forward wild animals in reference to ideas concerning sentience and mindedness, as well as Donaldson and Kymlicka's (2011) ideas about granting rights to animals. I will also discuss how these ideas contribute to achieving cohabitation.

This thesis has put forward the idea of mindedness to present animals as sentient beings (see Chapter 4). As such, this research contributes to the growing body of scholarly literature about demonstrating wild animals as sentient beings (Bradshaw, 2017; De Waal, 2016; Goodall, 2009; Low, 2012) and mindedness (Laurier et al., 2006). Regarding wild animals as sentient beings is not about attributing intelligence similar to that of humans to them. It is about their abilities to sense, feel and to operate on more than programmed instincts alone (Bekoff & Pierce, 2017). Hereby, the – often quoted – statement by Charles Darwin in 1871 is relevant: *"differences between human and animal mental lives are more of degree, not kind"* (Darwin, 1871 in Bradshaw, 2017, p. 2). In fact, and based on neuroscientific research, a wide array of animals, such as snakes, fish and bears, can be seen as sentient beings that affect each other, as well as their environment, including humans (Bradshaw, 2017). Such scientific evidence of animal sentience and intelligence is especially relevant for managing such wild animals as have been examined in this thesis, animals that can be described as often unruly, opportunistic, and highly adaptable to new (human) surroundings. These are wild animals that have the ability to thrive well outside their traditional habitats, such as raccoons (Pacini-Ketchabaw & Nxumalo, 2016), foxes (Cassidy & Mills, 2012), mountain lions (Collard, 2012; Gullo et al., 1998), and the Australian white ibis (McKiernan & Instone, 2016). They are flexible in their behavior due to their intelligence, ability to learn from experience and examples, and have, as such, the ability to adapt to the presence of humans. Nevertheless, employing these insights to wildlife management practices is still an underexplored and underdeveloped research area (Bradshaw, 2017). This research has added to this research area in that it has shown that relying on animal sentience can be observed in wildlife management practices. More specific and important to a reconsideration of wildlife management informed by ideas of wild animals as sentient beings, is to prevent a decontextualized understanding of animal sentience. This research has indicated that employing insights about animal intelligence to practices of wildlife management involves a

focus on human-animal-landscape interactions, or human-nonhuman collectives. Subsequently, these interactions are the focus of management interventions, such as the discussed cohabitation strategies. This focus on interactions and intelligence as constituted in these interactions through processes of shared learning, is captured by the idea of mindedness as discussed in Chapter 4. However, additional research is still needed with regard to future human-wildlife challenges. For example, based on indications that many species are able to empathize with members of their own species as well as with other species, including humans, several researchers suggest that a focus on the role of empathy in human-animal relations would advance this type of research (Bradshaw, 2017; Hurn, 2012; De Waal, 2009). Since *"numbers and behavior do not tell the whole story"* (Bradshaw, 2017, p. 16), this thesis has provided an alternative approach to understanding and managing human-wild animal interactions. Thereby, this research has contributed to the growing scientific insights into human and animal sensibilities and their similarities, differences and relationships. In that way, it has contributed to supporting highlighting wild animals in wildlife management practices and to supporting advancing and foregrounding a multinatural approach to achieve cohabitation between humans and wild animals.

Another way to listen to the 'voices' of wild animals can be found in animal rights literature (Donaldson & Kymlicka, 2011). I especially address Donaldson and Kymlicka's description of a zoopolis, a political community of humans and animals in which both (peacefully) share the same space. In describing a zoopolis, they propose three distinctive patterns of human-animal relationships, or 'animal-rights-categories': sovereignty, denizenship, and citizenship. These three types of relationships are based on different sorts of human-animal interactions and involve different potential behavioral modifications, mainly on the part of the animal. They distinguish three categories of animals that are associated with the suggested granted 'rights': respectively, 'wild animals', 'liminal animals' and 'domestic animals'. Wild animals are those animals that live relatively independent of humans. Liminal animals are animals that live and have adapted to live amongst humans but are not dependent on humans in the same way as domesticated animals. Domestic animals are those animals that live amongst humans, such as pets, and have a relation of dependency with humans. Based on this typology, the 'wild animals' examined in this research can be described as 'wild animals' that have the potential to become liminal. Prevalently employed wildlife management strategies are generally aimed at preventing wild animals from becoming liminal. Based on these animal rights categories, when wild animals move towards liminality, questions are raised concerning their 'right' to be living amongst humans (cf. Cassidy & Mills, 2012). However, in examining the categories posed by Donaldson and Kymlicka in the light

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of this research, other problems arise concerning their rigid delineation of spaces and their categorical judgements. First, as outlined earlier in this thesis, such a separation between 'wild' and 'liminal' is problematic in the current era. The separation of wild animal from human spaces has become untenable due to limited spaces to roam and restricted resources; the 'wild animals' are in fact surrounding us (Whatmore & Thorne, 1998). In fact, to think in terms of 'wild' animals that belong 'out there' – out there in their wild, sovereign territories or in nature reserves – may result in wildlife management strategies involving building more fences, killing more animals or other confinement strategies indicating rigid boundaries. Moreover, Donaldson and Kymlicka's categorization stimulates thinking in dichotomies rather than the dynamic, ongoing interactions and relations discussed in this thesis. The relationships described by Donaldson and Kymlicka reflect the various types of obligations humans appear to have with respect to the different categories of animals they defined. In the practice of wildlife management, however, that would be confusing. For instance, in human-wildlife conflict situations, confusion arises concerning which animals are declared 'liminal' or 'wild' – and when. It remains unclear whose and what rights should be considered in deciding on or deploying management strategies (or not). In addition, (wild) animals move around, they cross boundaries of spatial areas and, as such, it would be possible that they are granted several rights based on where that animal moves and, linked to this, different management strategies might apply to them. As this research has shown, wildlife managers already find it difficult to distinguish individual wild animals from their fellow wild creatures. The need to take the different 'animal-rights categories' into account would arguably only add to the confusion and create new problems for wildlife management. Still, as Whatmore and Thorne (1998) contend, the term 'wild', is useful as a political strategy for enabling particular characterizations of animals in comparison to, for example, domesticated animals, and enabling conservation as well as the employment of particular (cohabitation) strategies. Synthesizing my research, I suggest that this literature, with its use of distinct categories such as sovereignty that are generally explicitly related to particular spatial areas and by granting of particular rights to wild animals, does not contribute to pursuing cohabitation between humans and wild animals as it has been construed in this thesis. In terms of cohabitation, the idea of sovereignty (which could also be phrased as autonomy) would be expressed by the doings and movements of the involved wild animals in interaction with humans. This focus on interactions also points to the idea that mutual human-animal communication (Driessen, 2014; Meijer, 2017b) is context specific, not to be pre-determined by policy (Meijer, 2017a). Indeed, such a formulation of 'autonomy' contributes to thinking in terms of granting rights to wild animals and would be particularly useful for wildlife

management if this knowledge could be translated into management strategies through which we – humans – come to respect the animal's sovereignty (cf. Meijer, 2017a). For instance, this would imply that cohabitation strategies would express this respect, by encouraging mutual affective learning between humans and animals, rather than by practicing exclusion or more lethal management strategies. As this thesis has indicated, wild animals are also able to communicate in a way that we might understand and act with. Although, considering human-animal relations in light of animal rights literature has not been one of the aims of this research, Donaldson and Kymlicka's (2011) ideas about how to highlight the wild animals living amongst us and finding a way to live together with them contributes to discussions about addressing and foregrounding wild animals in the complexity of modern society (Bear & Eden, 2011; Hiedanpää et al., 2012; Hinchliffe et al., 2005; Hobson, 2007; Ingold, 1994; Lorimer, 2006a; Lorimer, 2010a; Meijer, 2017b; Philo & Wilbert, 2000; Wolch & Emel, 1998).

Summarizing this thesis, I consider that wildlife management practices, especially those aiming to achieve cohabitation, are always in progress, having no steady state. These practices involve and invite dialogue and require continuous attention, as well as continuous awareness of one's own being in relation with another, whether human or wild animal, as well as with the surrounding environment. Accordingly, my research does not end the ongoing debate regarding how to achieve cohabitation between humans and wild animals: rather, it opens it up

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Bibliography

Appendices

Summary

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  certificate**

List of publications

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Acknowledgements

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Appendix I: Interviews and interview questions

In-depth interviews conducted with wildlife managers, wildlife policymakers, wildlife researchers and local permanent residents were an integral part of both case studies in this research. Focus group participants were excluded from the group of local permanent residents interviewed, though volunteers related to the management practices of black bears or wild boars were included along with other local residents living in the respective areas.

A total of 37 in-depth interviews were held in the black bear case study:

> Wildlife managers: 13
>
> Wildlife policymakers: 6
>
> Wildlife researchers: 8
>
> Local permanent residents: 10

A total of 31 in-depth interviews were held in the wild boar case study:

> Wildlife managers: 10
>
> Wildlife policymakers: 10
>
> Wildlife researchers: 3
>
> Local permanent residents: 8

Interview questions
Different topics were emphasized depending on the respondents (e.g., field practices, policy, research, experiences with the respective wild animal in the surrounding). All topics were related to the respective wildlife management practices. During the interviews I also focused on the use of and references to particular spaces, data and categories by the respondents. Additionally, if applicable, I explored recent management interventions with the intention of augmenting my insight into particular key-incidents with the respective wild animals. Examples of interview questions in both the black bear and wild boar case are:

> *"How do you describe current black bear/wild boar management?"*;

> *"Where are black bears/wild boars allowed formally and according to you?"*;

"What is most important in managing black bears/wild boars in your opinion?";

"Who are involved in this management and who not?";

"Can you describe an example of a recent conflict and how that was dealt with?";

"What is – according to you – the largest problem in current black bear/wild boar management?";

"What knowledge is – according to you – currently missing or not used, but important to prevent conflict situations?";

"How do you see the future of black bear/wild boar management in [location]?";

"How would you describe the role or function of the black bear/wild boar here?"

Appendix II: Focus groups and propositions

The three focus groups held in the black bear case were located across the Colorado Front Range of the Rocky Mountains in Colorado, USA, (north-east, east, south) so that spatially different areas where interactions between humans and wild animals occur would be represented. Similarly, the four focus groups that were held in the wild boar case were located across the Veluwe, the Netherlands (twice in the north-east, one in the middle, one south-west). In the north-east a second focus group was held in the same village two years after the first focus group because of a particular management intervention that was highly debated in that area (the intended intervention involved the placement of a fence because of complaints about wild boars in the town centre). All locations were selected based on known conflicts between humans and black bears or humans and wild boars in those areas. In both cases the focus groups included local permanent residents of villages, because they knew the area very well and were in the position to share local stories about black bear or wild boar encounters, including stories about their management.

Propositions
The propositions presented in the focus group sessions were:

For the black bear case:

> *"There are too many black bears in Colorado."*;

> *"The black bear is a nuisance."*;

> *"The black bear only belongs outside the built-up area."*;

> *"Aimed shooting is the best management strategy."*;

> *"Aimed education of residents is the best management strategy."*

> *"Wildlife Managers and Policymakers are responsible, not us."*

For the wild boar case:

> *"There are too many wild boars at the Veluwe."*;

> *"The wild boar is a nuisance."*;

> *"The wild boar only belongs outside the built-up area."*;

> *"Aimed shooting is the best management strategy."*;

> *"Wildlife Manager and Policymakers don't listen to us."*

Summary

Worldwide conflicts between humans and wild animals continue to increase. These conflicts are inherently complex and wildlife management faces many difficulties in attempting to anticipate and control them. Managing such conflicts involves the use of and reliance on spaces, data, and categories in deciding which wildlife management strategies to implement. However, these factors are not self-evident and therefore often highly contested. The employed wildlife management strategies are typically based on rigid spaces, data and categories and are focused on controlling wild animals and separating them from humans.

Cohabitation between humans and wild animals is discussed as a suggested alternative to intense control of wild animals. Its focus is on a dynamic approach to spaces, data and categories, which has the potential to generate cohabitation strategies that require the use of flexible and dynamic boundaries. This dynamic approach embraces an inclusive process that shifts focus from either humans or wild animals to a process that focusses on the interactions between them and the landscape where these interactions take place. The emphasis is on the 'co' in *co*-habitation, reflecting the mutuality involved in these interactions, including mutual adjustments and mutual learning by both humans and wild animals. Such a mutual approach to understanding human-wild animal interactions relies on in-depth knowledge of both the interactions and the complex of activities between human, wild animal and landscape that are involved. This research seeks to advance insight into wildlife management practices that are confronted by human-wildlife conflicts and explore ways in which cohabitation might be achieved. The analytical focus is therefore on the relations between humans, wild animals, and the landscape in which they dwell. Specifically, the focus is on examining which spaces, data and categories articulated in wildlife management practices could contribute to bringing about cohabitation between humans and wild animals. Accordingly, the following set of research questions guide this research:

How can wildlife management practices achieve cohabitation between humans and wild animals?

1. What is the role of space, data and categories in wildlife management?
2. Which cohabitation strategies can be identified in wildlife management practices?
3. In what ways do the acquired insights contribute to a better understanding of managing human-wildlife interactions?

To answer these research questions an interpretive multispecies research approach has been employed in order to address the various ways humans and wild animals respond to each other as they roam in the landscape. The research consists of a literature study regarding the construction of invasiveness in science, policy and wildlife management, as well as two case studies: black bear management on the Colorado Front Range of the Rocky Mountains in Colorado, USA and wild boar management at the Veluwe, the Netherlands. Because of the emphasis on human-wild animal interactions, this research employs a *multispecies-ethnography* in the two cases. Data was collected by means of in-depth interviews, participant-observations, focus groups, and textual analysis of relevant documents, particularly documents selected from the ethological and ecological literature. In data analysis, an iterative approach was used with a specific focus on analyzing 'key-incidents'. This interpretive multispecies research approach enabled me to gain in-depth insight into the respective wildlife management practices and, in particular, the respective human-wildlife-landscape interactions. This thesis has been compiled in a publication-based format. Accordingly, Chapters 2 to 4 are written as articles for peer-reviewed journals and Chapter 5 is written as a peer-reviewed book chapter.

Chapter 2 contains an analysis of the categorization of invasive species. The categorization of species and individual animals as invasive can result in diverging and sometimes serious consequences in terms of how they are treated in practice. Invasiveness is analyzed in three different domains: science, policy and wildlife management. It is demonstrated that various constructions of invasiveness exist based on different assessments of the origin, behavior, and impact of the invasives. More precisely, the focus is on the different conceptions of *space* and the role of *data* in the *categorization* of invasives. The chapter demonstrates that domains may correspond in their categorization of invasive species based on their origin, behavior, and impact, but differ in how they treat space and data in their assessment of these features. It is demonstrated that the focus on individual animals and groups of animals in wildlife management practices, in contrast to science and policy, necessitates detailed and continuous data about the location, actions, and numbers of these animals. In fact, it is these human-wild animal interactions that inform the actual management of invasives. This chapter reveals the dynamic, context-specific nature of the categorization of invasive species.

Chapter 3 presents an in-depth examination of black bear management on the Colorado Front Range, USA. The concept of cohabitation, which suggests that humans and wild animals – should – share the same space, is further explored in this chapter. The chapter highlights the 'co' in cohabitation in that aiming at cohabitation requires that wildlife management be approached as an interactive and dynamic

endeavour involving humans, wild animals and landscape. It introduces the concept of multi-sensory writing and reading to analyse these dynamic, and interactive spatial interactions. Based on the study of black bear management, this chapter demonstrates that to pursue cohabitation in wildlife management requires assigning a central role to human-wild animal-landscape interactions, and to the consideration of wild animals, in this case black bears, as participants in the respective wildlife management practices.

Chapter 4 presents an in-depth examination of wild boar management at the Veluwe, the Netherlands. The chapter's emphasis is on the development of an understanding of mindedness that draws on processes of affective learning. The concepts of affect, attunement and animal subjectivities are employed to explore this conceptualization of mindedness in wild boar management. The chapter begins with an explanation of how the numero-politics employed in wildlife management to legitimize decisions presumes animal minds to be static and generically defined by species. It also explicates the presumption that their presence and behavior is context independent, while noting at the same time that in wildlife management practices affective relationships between humans and wild animals are inevitably formed to produce these quantitative data. Subsequently, the various entanglements of humans, wild boars and the landscape are described, demonstrating the mutuality that is involved in knowing and managing wildlife. It is argued that the proposed idea of mindedness helps to demonstrate how various – individual or collective – forms of human and non-human mindedness are implicated in management practices but remain invisible and underappreciated in formal accounts. The chapter ends by describing a multinatural approach to the management of wildlife that explicitly builds on an acknowledgment of mindedness as a feature of individuals, collectives and landscapes.

Chapter 5 offers a comparison between the two cases. It discusses the boundaries that are involved in decisions about what management strategy to employ in preventing and disentangling human-wildlife conflicts. First, the dynamics in boundary drawing are discussed in relation to coexistence (cohabitation). The chapter makes a distinction between strategies of confinement and strategies of alignment. The case of wild boar management at the Veluwe, the Netherlands is used to clarify the notion of 'confinement', and the case of black bear management on the Colorado Front Range, USA clarifies the notion of 'alignment'. The emphasis in both cases is on how and what kind of boundaries are drawn to manage the respective wild animals, and whether or not they contribute to cohabitation. These cases demonstrate that wildlife management practices typically employ apparently obvious, rigid boundaries, pre-determined by policy, which propagate thinking in

terms of humans and wild animals as separate entities requiring separation to be accomplished by imposing rigid boundaries (e.g. physical or numerical boundaries). However, in practice, these pre-determined boundaries are often blurred and frequently need to be adjusted to prevent and disentangle human-wildlife conflicts. In addition, the cases demonstrate that living in multispecies communities requires viewing humans and wild animals as aligned, intertwined entities. In comparing the cases, both wildlife management practices in fact display management strategies of confinement as well as management strategies of alignment. The chapter concludes that both strategies are required to bring about coexistence. However, strategies of alignment are prerequisite to opening boundaries between humans and wildlife in order to manage their conflicts as relational.

The final chapter, **Chapter 6**, synthesises the findings of the two cases, answers the research questions, discusses the theoretical contribution of this thesis, and reflects on the employed interpretive multispecies research approach. The chapter also provides suggestions for future research and for promoting cohabitation, including how to advance the position of wild animals in wildlife management. This research concludes that the spaces, data and categories that are employed in wildlife management to assist wildlife management strategies, are commonly presented as clear and unambiguous and that they are taken for granted. Wildlife management based on the use of and reliance on fixed and pre-determined spaces, data and categories is, however, observed to be at odds with the dynamic and contingent character of human-wildlife interactions in practice. A reconceptualization of wildlife management that emphasizes the processes and relations between humans, wild animals, and the landscapes where they roam, is therefore required. This will in turn result in a redefinition of the respective spaces, data and categories employed when making management decisions. Such a dynamic understanding contributes to furthering the understanding and pursuit of cohabitation between humans and wild animals. Indeed, the interactions between humans, wild animals and landscapes are key to the five cohabitation strategies identified in the two cases: zoning, human-wild animal learning, regulation, joint usage, and letting go. Additionally, the design and implementation of these cohabitation strategies require an understanding of multi-sensory communication between humans and wild animals and involve the ongoing processes of learning, remembering and adaptation through varied and repeated encounters. However, the cases have shown that human-wild animal cohabitation is far from having been achieved. To promote the achievement of cohabitation, this research has generated four important insights concerning: *mutuality* between humans and wild animals; processes of *affective learning* between humans and wild animals; *differences* between humans and wild animals; and

mindedness of individuals and collectives. A dynamic approach to wildlife management, such as the multinatural approach described in this thesis, is based on insights like these. Wildlife management endeavoring to attain cohabitation between humans and wild animals will need to shift its perspective from 'acting upon' – prevalent in western wildlife management practices – to 'acting with' wild animals. To advance cohabitation in wildlife management, three moves have been suggested. The first move calls for the generation of so-called micro-geographies of multispecies cohabitation. The second involves combining formal ways of knowing with informal, non-standardized, non-representational ways of knowing. The third concerns the fact that an open-ended approach to wildlife management requires acknowledging that there is no one universal solution to managing human-wildlife interactions and that full control of the behavior of wild animals is impossible.

The methodological reflections indicate that the employed interpretive multispecies research approach has been proven useful in arriving at a detailed understanding of human-wild animal interactions through its relational, interdisciplinary, and transdisciplinary approach. The participant-observations were particularly useful in revealing the multi-sensory and affective learning processes occurring in the respective wildlife management practices. Additionally, a focus on key-incidents, and the generation of management stories about human-wild animal-landscape interactions proved effective as a way to grasp the complexity of human-wildlife conflict management. Three critical remarks are discussed regarding this research approach. These concern the research's attempt to approach humans and wild animals symmetrically, the research's attempt at interdisciplinarity, and the research's perspective regarding the landscape in which the human-wild animal interactions take place. Finally, the concluding chapter indicates that this research has contributed to the growing scientific insights into human and animal sensibilities, their similarities, differences and relationships, as well as to thinking in terms of granting rights to wild animals. In all these ways, this research contributes to highlighting the 'voices' of wild animals.
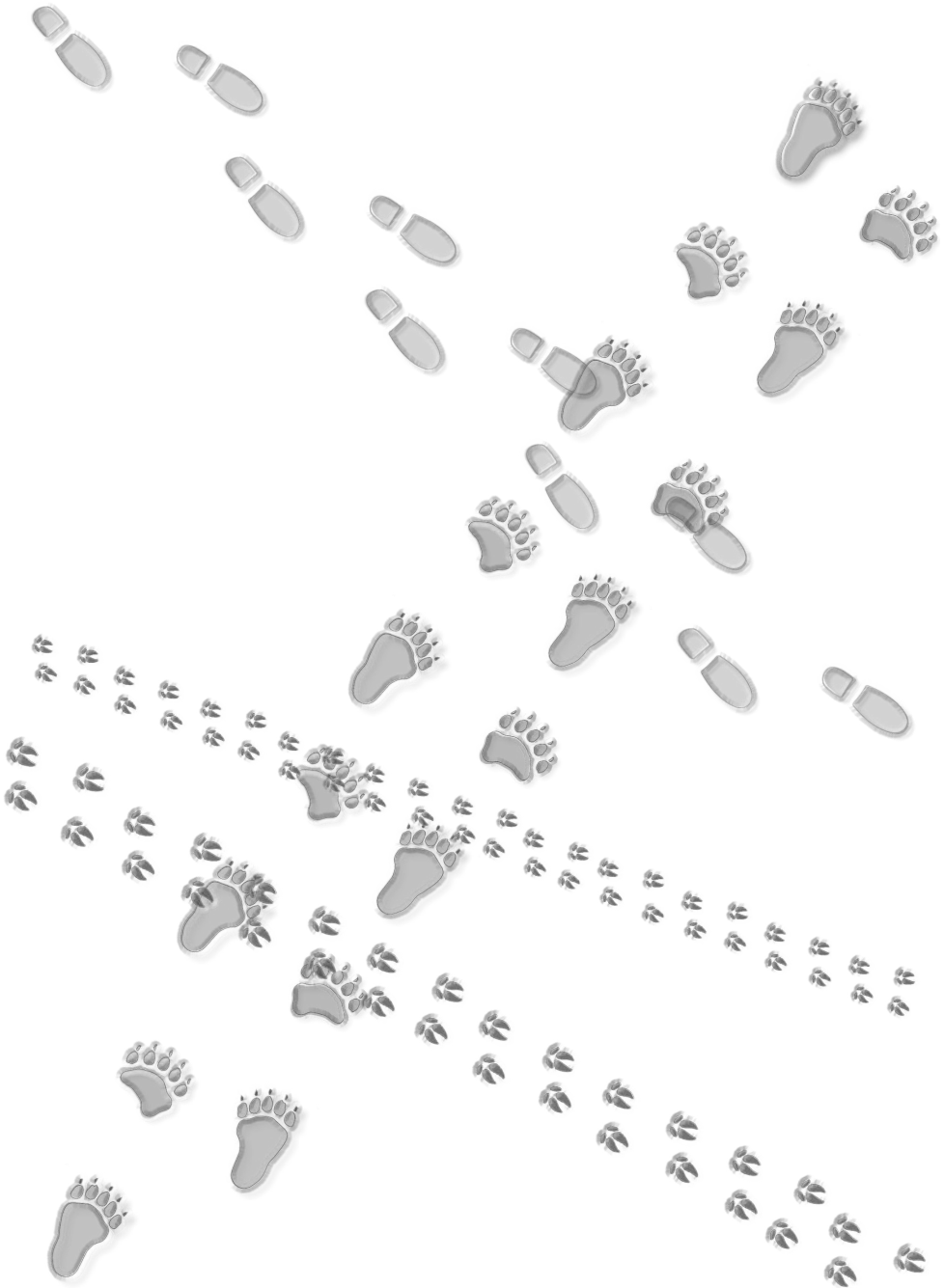
Samenvatting

Conflicten tussen mensen en wilde dieren nemen wereldwijd steeds meer toe, terwijl wildbeheer in haar huidige vorm tegen diverse moeilijkheden aanloopt om deze conflicten te voorkomen of in toom te houden. Wildbeheer is gebaseerd op drie centrale factoren: ruimtes, gegevens, en categorieën. Echter, deze factoren zijn in hun betekenis en gebruik niet vaststaand. Bovendien zijn ze onderhevig aan kritiek vanwege de beheermaatregelen die hieruit kunnen voortvloeien. Beheermaatregelen zijn doorgaans gebaseerd op vastomlijnde en vooraf vastgestelde ruimtes, vaststaande en algemene gegevens, en star omkaderde categorieën. Daarmee ligt het huidige accent van wildbeheer op het onder controle houden van wilde dieren en het strikt gescheiden houden van wilde dieren en mensen.

In dit onderzoek bespreek ik het idee van cohabitatie, ofwel het samenleven tussen mensen en wilde dieren. Dit stel ik voor als een alternatief voor het gangbare intensief beheren en de controle houden over wilde dieren binnen, vooral westers, wildbeheer. Cohabitatie, zoals omschreven in dit hoofdstuk, maakt gebruik van een dynamische benadering van ruimtes, gegevens en categorieën. Door middel van het gebruik van flexibele en dynamische grenzen is het mogelijk om tot cohabitatie strategieën te kunnen komen die cohabitatie tussen mensen en wilde dieren als doel hebben. Zo'n dynamische benadering houdt in dat binnen wildbeheer de focus niet meer alleen ligt op de wilde dieren of alleen op de mensen in een bepaald gebied, maar dat het beheer draait om een alomvattend proces. Specifiek ligt dan de focus op de interacties tussen mensen en wilde dieren, en het landschap waarin deze interacties plaatsvinden. De nadruk ligt dan ook op de 'co' van *co*-habitatie, wat het wederzijdse karakter van deze interacties benadrukt. Dit betekent dat zowel mensen als dieren zich aan elkaar kunnen aanpassen en van elkaar leren. Om dit wederzijdse karakter van zulke mens-dier interacties te begrijpen is diepgaande kennis nodig van zowel de interacties zelf, als de daarbij behoren complexe activiteiten tussen mens, wild dier, en het landschap. Met dit onderzoek heb ik als doel om beter inzicht te krijgen in wildbeheerpraktijken die te maken hebben met mens-wild conflicten. Tevens onderzoek ik op welke manieren cohabitatie bereikt kan worden. De analytische focus van het onderzoek zijn de relaties tussen mensen, wilde dieren en het landschap waarin ze zich bevinden. Specifiek geformuleerd ligt de focus van het onderzoek allereerst op het nagaan welke ruimtes, gegevens en categorieën in wildbeheerpraktijken gebruikt worden en vervolgens welke van deze ook bijdragen aan cohabitatie tussen mensen en wilde dieren. Dit heeft tot de volgende reeks van onderzoeksvragen geleidt die als leidraad zijn gebruikt voor dit onderzoek:

Hoe kunnen wildbeheerpraktijken cohabitatie bereiken tussen mensen en wilde dieren?

1. Wat is de rol van ruimtes, gegevens en categorieën in wildbeheer?
2. Welke cohabitatie strategieën kunnen geïdentificeerd worden in wildbeheerpraktijken?
3. Op welke manieren dragen de verkregen inzichten bij aan een beter begrip van het beheren van mens-wild interacties?

In het beantwoorden van deze onderzoeksvragen gebruik ik een interpretatieve onderzoeksbenadering waarbij meerdere soorten meegenomen worden. Deze soorten hebben betrekking op zowel mensen, dieren als andere levende wezens. Op deze manier is het mogelijk om de diverse manieren te bestuderen waarop mensen en wilde dieren op elkaar reageren wanneer ze door het landschap bewegen. Het onderzoek bestaat uit een literatuur studie naar de verschillende opvattingen van invasiviteit in wetenschap, beleid en wildbeheer, en twee case studies: zwarte beren beheer op de Colorado Front Range van de Rocky Mountains in Colorado, USA en wilde zwijnen beheer op de Veluwe in Nederland. Doordat de nadruk van het onderzoek ligt op de interacties tussen mensen en wilde dieren gebruik ik in de twee cases een etnografie die gericht is op meerdere soorten. Ik heb gegevens verzameld door het houden van diepte-interviews, het doen van observaties als deelnemer binnen wildbeheerpraktijken, het houden van focusgroepen en tekstuele analyse van relevante documenten. Ik heb ook specifiek documenten geselecteerd uit de ethologische en ecologische literatuur. De analyse van alle data was een doorlopend analyseproces, waarbij de focus lag op het analyseren van wezenlijke conflicten. De beschreven onderzoeksbenadering heeft het mogelijk gemaakt om diepgaand inzicht te verkrijgen in de betreffende wildbeheerpraktijken en met name inzicht te krijgen in de betreffende interacties tussen mens, wild, en landschap. Dit proefschrift bestaat uit vier wetenschappelijke publicaties. Hoofdstuk 2 tot en met 4 zijn geschreven als artikelen voor wetenschappelijke tijdschriften en hoofdstuk 5 betreft een wetenschappelijk boekhoofdstuk.

Hoofdstuk 2 beschrijft een analyse van het categoriseren van invasieve soorten. Het categoriseren van individuele dieren als invasief kan grote en uiteenlopende consequenties hebben hoe deze dieren uiteindelijk beheerd worden in de praktijk. In dit hoofdstuk wordt invasiviteit geanalyseerd binnen drie verschillende domeinen: wetenschap, beleid en wildbeheer. Dit hoofdstuk laat zien dat er verschillende opvattingen over invasiviteit bestaan. Deze verschillen zijn gebaseerd op verschillende beoordelingen van de oorsprong, het gedrag en de invloed van de betreffende invasieve dieren. Nog specifieker gezegd, het draait met name om

verschillen in opvattingen over de ruimte en de rol van gegevens in het categoriseren van invasieve soorten. In het hoofdstuk wordt aangetoond dat er overeenkomsten zijn tussen de drie domeinen voor wat betreft het categoriseren van invasieve soorten gebaseerd op hun oorsprong, gedrag en invloed. De drie domeinen verschillen echter in hoe ze deze kenmerken bepalen, namelijk op basis van verschillende ideeën over ruimtes en gegevens. Het hoofdstuk laat ook een contrast zien tussen enerzijds wildbeheerpraktijken en anderzijds wetenschap en beleid. In wildbeheerpraktijken ligt de nadruk op individuele dieren en groepen van dieren – en niet zozeer op soorten –, waardoor andere gegevens nodig zijn. Namelijk een onafgebroken en gedetailleerde stroom van gegevens over de locatie, de acties en aantallen dieren. In feite wordt het uiteindelijke beheer van invasieve dieren bepaald door de mens-dier interacties die ten grondslag liggen aan het verkrijgen van deze stroom van gegevens. In dit hoofdstuk wordt dan ook geconcludeerd dat het categoriseren van invasieve soorten dynamisch en context-specifiek is.

In **Hoofdstuk 3** presenteer ik een grondige analyse van zwarte beren beheer op de Colorado Front Range, USA. In dit hoofdstuk ga ik verder in op het concept cohabitatie. Cohabitatie suggereert dat mensen en wilde dieren dezelfde levensruimte samen – moeten – delen. De nadruk ligt daarbij op de 'co' in cohabitatie. Om cohabitatie na te streven is het belangrijk om wildbeheer te benaderen als een dynamisch en interactief geheel waarbij zowel mensen, als wilde dieren en het landschap betrokken zijn. Om deze dynamische en interactieve interacties te analyseren wordt in dit hoofdstuk gebruik gemaakt van een concept dat inzoomt op de diverse zintuigelijke waarnemingsvermogens van mensen en dieren. Er wordt gesteld dat op basis van diverse zintuigelijke vermogens, zowel mensen als dieren op hun eigen wijze 'schrijven' en 'lezen' in interactie met elkaar. Dit 'schrijven' en 'lezen', ofwel 'communicatie', vindt daarbij in het landschap plaats waar de betreffende mens-dier interacties plaatsvinden. En deze manier van communiceren gebeurd door middel van het reageren op en interpreteren van diverse 'signalen' of 'sporen'. Aan de hand van de zwarte beren case laat dit hoofdstuk zien dat om cohabitatie na de streven de interacties tussen mensen, wilde dieren, en landschappen centraal moeten komen te staan binnen het beheer. Een centrale rol speelt hierbij de overweging om wilde dieren, in dit geval zwarte beren, als deelnemers te beschouwen binnen wildbeheerpraktijken.

In **Hoofdstuk 4** presenteer ik een grondige analyse van wilde zwijnen beheer op de Veluwe in Nederland. In het hoofdstuk ligt de nadruk op het ontwikkelen van het idee van dieren als intelligente en gevoelige wezens, als individu en als groep, en dat zelfs landschappen waar deze dieren voorkomen gezien kunnen worden als lerende, actieve en dynamische eenheden. Dit resulteert vervolgens in de opvatting dat zowel

mens, dier als landschap voortdurend bewegen en ontwikkelen in leerprocessen. Om deze opvatting te onderbouwen wordt in het hoofdstuk gebruik gemaakt van diverse concepten. Deze concepten helpen om te laten zien dat het kennen of het tellen van dieren niet los gezien kan worden van gevoelsmatige en fysieke ervaringen met deze dieren. Daarbij speelt een bepaalde vorm van afstemming tussen beiden een belangrijke rol. Daarbij is een andere overweging van belang, namelijk dat dieren een eigen karakter hebben en voortdurend leren en voortdurend reageren op hun omgeving en de wijze waarop ze beheerd worden. In het eerste deel van het hoofdstuk wordt uitgelegd dat binnen wildbeheer veelvuldig gebruik gemaakt wordt van zogenaamde getallenpolitiek om beslissingen in wildbeheer te legitimeren. Echter, zo'n focus op getallenpolitiek verondersteld dat het geheugen van dieren iets statisch is en per diersoort algemeen te definiëren is. Zo'n focus verondersteld ook dat hun aanwezigheid en gedrag context-onafhankelijk is. Echter, om deze getallen in de praktijk te verkrijgen, blijkt het onvermijdelijk te zijn dat er gevoelsmatige en fysieke relaties ontstaan tussen mensen en wilde dieren. In het tweede deel van het hoofdstuk wordt het wederzijdse karakter, dat wil zeggen de voortdurende wisselwerking en beïnvloeding tussen mensen, wilde zwijnen en het landschap, aangetoond door een beschrijving van diverse relaties tussen hen. Het blijkt dat het (h)erkennen van zowel individuele als collectieve lerende en dynamische vormen eigen is binnen de praktijk van wildbeheer, maar onzichtbaar blijft en ondergewaardeerd wordt in formele omschrijvingen van wildbeheer. Gebaseerd op deze inzichten eindigt het hoofdstuk met een beschrijving van een benadering van wildbeheer waarbij 'de natuur' beschouwd wordt als een samenhangend geheel van relaties tussen mensen, dieren, landschappen, waarbij relaties voortdurend veranderen door leerprocessen, nieuwe gedragingen etc. In deze benadering staan de interacties centraal. Deze benadering heeft tot gevolg dat gestandaardiseerde kennis en universeel toepasbare beheermaatregelen niet langer de norm zijn, relaties niet als vanzelfsprekend beschouwd kunnen worden en dat volledige controle over wilde dieren niet meer aanvaardbaar is.

In **Hoofdstuk 5** worden beide cases met elkaar vergeleken. Het centrale thema in het hoofdstuk is met wat voor soort grenzen wildbeheer te maken heeft in het nemen van beslissingen over welke wildbeheermaatregelen ze kunnen inzetten om conflicten tussen mensen en wilde dieren te voorkomen. Ik bespreek daarbij de dynamiek in het trekken van grenzen in relatie tot coexistentie (cohabitatie). In het hoofdstuk wordt onderscheid gemaakt tussen afscheidende strategieën en verbindende strategieën, waarbij de wilde zwijnen case vooral het idee van afscheiden illustreert, en de zwarte beren case vooral het idee van verbinden. De nadruk in beide cases ligt op het hoe en op wat voor soort grenzen er getrokken worden om de wilde zwijnen

dan wel de zwarte beren te beheren. Tevens wordt onderzocht of de getrokken grenzen bijdragen aan cohabitatie. Beide cases laten zien dat wildbeheerpraktijken over het algemeen harde, vaststaande grenzen gebruiken. Deze zijn veelal vooraf vastgelegd in beleidsplannen. Het gebruik van harde grenzen (zoals bijvoorbeeld fysieke of numerieke grenzen) bevordert echter het denken in termen van mensen en wilde dieren als afzonderlijke wezens die van elkaar gescheiden moeten worden. Echter, in de praktijk blijken deze vooraf vastgestelde grenzen vaak onduidelijk en vaag. Ze moeten zelfs regelmatig aangepast worden in het beheer van conflicten tussen mensen en wilde dieren. Beide cases laten zien dat mensen en wilde dieren gezien moeten worden als wezens die met elkaar verbonden zijn om uiteindelijk met meerdere soorten samen te kunnen leven. Door beide cases met elkaar te vergelijken laat ik zien dat in beide wildbeheerpraktijken zowel afscheidende als verbindende strategieën te vinden zijn. Als conclusie van dit hoofdstuk stel ik dat beide strategieën nodig zijn om tot cohabitatie te kunnen komen. Verbindende strategieën zijn echter een eerste vereiste om reeds aanwezige vaststaande grenzen tussen mensen en wilde dieren open te kunnen breken. Dit laatste is nodig om conflicten tussen mensen en wilde dieren als relationeel te kunnen gaan benaderen.

In het laatste hoofdstuk, **Hoofdstuk 6**, voeg ik alle bevindingen samen, beantwoord ik de onderzoeksvragen, bediscussieer de theoretische bijdrage van het proefschrift en reflecteer ik op de gebruikte interpretatieve onderzoeksbenadering waarbij meerdere soorten meegenomen worden. In dit hoofdstuk doe ik ook een aantal suggesties voor toekomstig onderzoek, en suggesties hoe cohabitatie bevorderd kan worden. Ik zal ook ingaan op het discussiepunt hoe de positie van wilde dieren in wildbeheer vergroot kan worden. Op basis van het onderzoek concludeer ik dat de gebruikte ruimtes, gegevens en categorieën om wildbeheermaatregelen te onderbouwen veelal gepresenteerd worden als duidelijk, ondubbelzinnig, en als vanzelfsprekend beschouwd worden. Dit onderzoek laat echter ook zien dat wildbeheer dat gebaseerd is op vastomlijnde en vooraf bepaalde ruimtes, gegevens en categorieën in contrast staat met het onvoorziene en dynamische karakter van interacties tussen mensen en wilde dieren in de praktijk. Een verandering van wildbeheer is nodig om juist deze processen en relaties tussen mensen, wilde dieren en landschappen centraal te stellen. Deze benadering van wildbeheer waarin processen en relaties benadrukt worden, vereist echter dat de daarbij behorende ruimtes, de benodigde gegevens en de gebruikte categorieën opnieuw gedefinieerd moeten worden om keuzes te kunnen maken rondom wildbeheermaatregelen. De besproken dynamische benadering vergroot zowel het inzicht in cohabitatie tussen mensen en wilde dieren en het draagt bij aan een bevordering ervan. In feite blijken het juist de interacties tussen mensen, wilde dieren en landschappen te zijn die

centraal staan in de vijf waargenomen cohabitatie strategieën in de twee cases: zonering, leren tussen mensen en wilde dieren, verordeningen, gezamenlijk gebruik en loslaten. Daarnaast blijkt dat het ontwikkelen en toepassen van deze cohabitatie strategieën inzicht vereist in de communicatie tussen mensen en wilde dieren voor wat betreft hun diverse zintuigelijke vermogens. Deze cohabitatie strategieën impliceren ook de aanwezigheid van alsmaar doorlopende processen van leren, onthouden, en aanpassen via uiteenlopende en herhaaldelijke ontmoetingen. De cases laten echter zien dan cohabitatie tussen mensen en wilde dieren bij lange na nog niet is bereikt. Uit dit onderzoek komen vier belangrijke inzichten naar voren om wel cohabitatie te kunnen bereiken: 1) het wederzijdse karakter tussen mensen en wilde dieren, 2) gevoelsmatige en fysieke leerprocessen tussen mensen en wilde dieren, 3) verschillen tussen mensen en wilde dieren, en 4) individuele en collectieve lerende en dynamische eenheden. Deze inzichten zijn de basis voor een dynamische benadering van wildbeheer, zoals de in dit proefschrift beschreven benadering waarbij 'de natuur' beschouwd wordt als een samenhangend geheel van relaties tussen mensen, dieren, landschappen, waarbij deze relaties voortdurend veranderen door leerprocessen, nieuwe gedragingen etc., en waarbij hun interacties centraal staan. In dit hoofdstuk concludeer ik dan ook dat wildbeheer een ander uitgangspunt nodig heeft om cohabitatie na te streven tussen mensen en wilde dieren: van 'controle over' – wat gangbaar is in westerse wildbeheerpraktijken – naar 'samen werken met' wilde dieren. Om zo'n verandering voor elkaar te krijgen doe ik drie voorstellen. Het eerste voorstel betreft het tot stand brengen van kleinschalige en tijdelijke vormen van cohabitatie tussen diverse soorten, zonder dat mensen volledige controle hebben over deze soorten. Het tweede voorstel betreft het combineren van formele vormen van kennis met informele, niet gestandaardiseerde, vormen van kennis om tot cohabitatie te komen. En het derde voorstel stelt dat bij een open, dynamische, benadering van wildbeheer geaccepteerd moet worden dat er geen universele oplossing voor handen is bij het beheren van interacties tussen mensen en wilde dieren. Volledige controle over het gedrag van wilde dieren is onmogelijk.

In de reflectie op de gebruikte methoden laat ik zien dat de relationele, interdisciplinaire en transdisciplinaire benadering van de gebruikte onderzoeksbenadering geschikt is gebleken om de interacties tussen mensen en wilde dieren gedetailleerd in kaart te brengen. Bijzonder zinvol waren de observaties als deelnemer in de onderzochte wildbeheerpraktijken om diepgaand inzicht te verkrijgen in de leerprocessen tussen mensen en wilde dieren voor wat betreft hun communicatie via diverse zintuigelijke waarnemingsvermogens en voor wat betreft de gevoelsmatige en fysieke leerprocessen tussen mensen en wilde dieren. Bovendien blijkt dat een focus op wezenlijke conflicten en het ontwikkelen van

verhalen over wildbeheer waarbij de interacties tussen mensen, wilde dieren en landschap centraal staan, effectieve manieren zijn om inzicht te krijgen in de complexiteit van conflicten tussen mensen en wilde dieren. Daarnaast bekritiseer ik nog drie punten die betrekking hebben op deze onderzoeksbenadering. De eerste betreft de poging om mensen en wilde dieren symmetrisch te benaderen in dit onderzoek. Het tweede punt gaat over de interdisciplinaire benadering van het onderzoek. En het derde punt gaat in op de wijze waarop het landschap, waarbinnen de interacties tussen mensen en wilde dieren plaatsvinden, benaderd is. Tenslotte eindig ik dit hoofdstuk met enerzijds een discussie over de bijdrage van dit onderzoek aan de alsmaar groeiende wetenschappelijke inzichten betreffende de overeenkomsten, verschillen en relaties in waarnemingsvermogens en bewustzijn van mensen en dieren. En anderzijds een discussie over de bijdrage van dit onderzoek aan de mogelijkheid om rechten aan wilde dieren toe te kennen. Op diverse manieren heeft dit onderzoek bijgedragen aan het meer op de voorgrond plaatsen van wilde dieren binnen wildbeheer en het nastreven van cohabitatie in het bijzonder.

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Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A Practical Course on the methodology of fieldwork	CERES Utrecht University	2009	2
Qualitative data analysis for development research	CERES Utrecht University	2009	1
From Topic to Proposal	WASS	2010	4
Social Theory and the Environment; An Introduction into Ecological Modernisation Theory	Wageningen University (Mansholt Graduate School, Sense)	2010	6
'Doing' Interpretative Analysis	WASS	2010	3
WTMC Summerschool 'Observing Experts Observing'	WTMC, Maastricht	2010	4
Interpretive Analysis	WASS	2011	1.5
Seminar Story Telling	WASS	2011	0.5
Writing ethnographic and other qualitative –interpretive research: An inductive learning approach	WASS	2012	3
Zoopolis, workshop with Sue Donaldson and Will Kymlicka	Netherlands Institute for Cultural Analysis	2015	1
B) General research related competences			
Organiser & participant Interpretive Analysis Discussion Group	WASS	2009-2013	2
Information Literacy PhD including EndNote Introduction	Wageningen University	2010	0.6
"Invasiveness: the construction of a category and its impact for conservation practices"	ECPR Joint Sessions, workshop 'Category-making and public policy', Münster, Germany	2010	1
"Managing the wild boar: perceptions from science, policy and society"	ECPR Joint Sessions, Antwerp, Belgium	2012	1
"Interpreting wildlife and its management: Perceptions from Research, Policy, Management and Society"	WASS Seminar Series	2012	1

"Living together or living apart? That is the question in wildlife management today"	IPA international conference, Wageningen, the Netherlands	2014	1.2
Introduction to animal behaviour	Wageningen University & Research (MOOC)	2017	1
"Managing wild minds: From control by numbers to a multinatural approach in wild boar management at the Veluwe the Netherlands"	WASS-PHD-Day, Wageningen	2018	1
"Wild minds seeking cohabitation"	Pathways Europe, Goslar, Germany	2018	1

C) Career related competences/personal development

PhD Competence Assessment	WGS	2009	0.3
Speedreading	Mark Tigchelaar	2011	0.4
PhD representative WASS Education Commission	WASS	2011-2014	2
WASS PhD Council	WASS	2011-2013	2
Reviewing a Scientific Paper	Wageningen University	2013	0.1
Voice and Presentation Skills Training	Voice Matters, Mariska Wessel	2014	0.4
Lecturing	Educational Staff Development Wageningen University	2015	0.8
Guest lecturer on human-wildlife topics in various BSc and MSc courses	Wageningen University	2013-2016	1
Teaching and co-organising various BSc and MSc courses	Wageningen University	2011-2013	1
Supervising four MSc thesis students, one MSc traineeship and three BSc thesis students	Wageningen University	2011-2014	1.2

Total			**45.0**

*One credit according to ECTS is on average equivalent to 28 hours of study load

List of publications

Boonman-Berson, S., & Van Bommel, S. (forthcoming) Multispecies-ethnographies in exploring human-(wild) animal interactions. *In: Colombino, A. and Steinkrüger, J. E. (Eds.). Methods in human-animal studies: the question(s) of animal(s) in practice.* To be published in the Routledge Human-Animal Studies Series

Boonman-Berson, S., Driessen, C., Turnhout, E. (forthcoming) Managing wild minds: From control by numbers to a multinatural approach in wild boar management at the Veluwe, the Netherlands. *Transactions of the Institute of British Geographers*

Boonman-Berson, S., Turnhout, E. & Carolan, M. (2016) Common Sensing: Human-black bear cohabitation practices in Colorado. *Geoforum*, 74, 192-201. DOI: 10.1016/j.geoforum.2016.06.010

Boonman-Berson, S. (2016) Blurred boundaries in wildlife management practices. *In: Bovenkerk, B. and Keulartz, J. (Eds). Animal Ethics in the Age of Humans: Blurring Boundaries in Human-animal Relationships*. The International Library of Environmental, Agricultural and Food Ethics, vol 23. Springer, Cham. DOI: 10.1007/978-3-319-44206-8_13

Boonman-Berson, S., Turnhout, E., & Van Tatenhove, J. (2014) Invasive species: The categorization of wildlife in science, policy, and wildlife management. *Land Use Policy*, 38, 204-212. DOI: 10.1016/j.landusepol.2013.11002

Boonman-Berson, S.H. & Turnhout, E. (2013) Globalising Biodiversity: Scientific Practices of Scaling and Databasing. *In: Arts, B., Behagel, J., Van Bommel, S., Koning, J. & Turnhout, E. (Eds). Forest and Nature Governance: A practice Based Approach*. Springer, Dordrecht the Netherlands

Plaa de, A. & **Boonman-Berson, S**. (2012) Richt wildbeheer op waar het om gaat. *Nieuwe Veluwe, 3*(12). *Non-scientific journal*

Turnhout, E. & **Boonman-Berson, S.H.** (2011) Databases, scaling practices, and the globalization of biodiversity. *Ecology and Society*, *16*(1), 35

Hilbers, J.P., **Boonman-Berson, S.H.** & Elands, B.H.M. (2011) Weinig Roodkapje-syndroom bij burgers Nijmegen. *Vakblad Natuur Bos Landschap*, 8(7), 26-29. *Non-scientific journal*

Boonman-Berson, S.H. (2010) Omgaan met meer zwijnen. *Nieuwe Veluwe, 3*(10). *Non-scientific journal*

List of presentations

Presentations, conferences and meetings that were related to my PhD-research:

2018

"Wild minds seeking cohabitation" at Pathways Europe 2018, theme: 'Human Dimensions of Fisheries and Wildlife: Resurrecting the Wild!?', 16-19 September, Goslar, Germany

"Managing wild minds: From control by numbers to a multinatural approach in wild boar management at the Veluwe the Netherlands" at WASS-PHD-Day, 6 June, Wageningen, the Netherlands

2017

Chair at the session: 'Zoos' ('Dierentuinen') at the Day of Environmental Philosophy ('Dag van de Milieufilosofie'), theme: 'Animals amongst us' ('Dieren in ons midden'), 22 April, Artis, Amsterdam, the Netherlands

2016

"Observeren van wilde zwijnen en meer…", guest lecture at course 'Research Methods for Communication Sciences', Communication, Philosophy and Technology – Centre for Integrative Development, 7 October, Wageningen University, Wageningen, the Netherlands

2015

Pitch at Symposium Dies Natalis 'Fascinating Nature', Wageningen University, 9 March, Wageningen, the Netherlands

"Wilde Zwijnen beheer in Nederland: Een numerieke en/of affectieve praktijk?" at Polderdieren symposium, 4 June, University of Amsterdam, the Netherlands

2014

"Living together or living apart? That is the question in wildlife management today"; Organising and presenting at panel 'Interpretive policy making in a more-than-human world: governing (with) animals' at IPA international conference, 3-5 July, Wageningen, the Netherlands

Co-organising and chair the methodology workshops at IPA international conference, 3-5 July, Wageningen, the Netherlands

"Living together or living apart?" at discussion group Visions of Nature, Radboud University Nijmegen, 19 June, Nijmegen, the Netherlands.

"Science and Expertise in nature and environment: Wolves in Yellowstone" guest lecture at course 'Science and expertise in nature and environment' (FNP 32806), Wageningen University, 10 November, Wageningen, the Netherlands

2013

"Black Bear-Human interactions: How to co-exist" at Alertis: 'Bear in Mind' International Bear Conference, 23-25 May, Rhenen, the Netherlands

"Wildbeheer: Mens, Dier en Ruimte", guest lecture at course 'People and forest and nature conservation' (FNP 23806), Wageningen University, 23 September, Wageningen, the Netherlands

2012

"Managing the wild boar: perceptions from science, policy and society" at ECPR Joint Sessions 2012, workshop 'Political Animals and Animal Politics', 10-15 April, Antwerp, Belgium

"Interpreting wildlife and its management: Perceptions from Research, Policy, Management and Society"; Co-organising and presenting: Interpreting the human-animal relation; Problematizing the integration of animals in interpretive research, WASS Seminar Series, 23 November, Wageningen, the Netherlands

"Invasiveness in the nature conservation debate: Wildlife Management in and around urban areas", poster presentation, WASS Midterm Review, International Advisory Board Meeting WASS for Forest and Nature Conservation Policy Group, 15 November, Wageningen, the Netherlands

2011

"Invasieve Soorten: Wat zijn het en hoe te handelen?", keynote speaker at Invexo, Communicatiewerkgroep, Interreg-project 'Invasieve exoten', 18 May, Goes, the Netherlands

"Invasiveness: the construction of a category and its impact for wildlife" at Panel: 'Post(human) imaginaries for a politics of human/non-human relations', IPA International Conference, 22-25 June, Cardiff, UK

"Return of the wolf in the Netherlands: Gain or Trouble"; co-organizer, together with RUW Foundation and WSBV Sylvatica, and facilitator of a debate about the return of the wolf in the Netherlands, 28 November, Wageningen, the Netherlands

2010

"Invasiveness: the construction of a category and its impact for conservation practices" at ECPR Joint Sessions, workshop 'Category-making and public policy', 22-27 March, Münster, Germany

"Invasive wildlife: the construction of a category and its impact for conservation practices", at discussion group Theoretical and Applied Ecology, Wageningen University, 25 May, Wageningen, the Netherlands

"Invasiveness: the construction of a category and its impact for conservation and recreation practices", poster presentation at International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas (MMV), 30 May-3 June, Wageningen, The Netherlands

Presenting at 'Midsummer night dream'; an evening about dreaming of Dutch Nature with experts in the field, Bosschap, 23 June, Rhenen, the Netherlands

"Invasive wildlife: the construction of a category and its impact for wildlife management practices" at Summer School WTMC on 'Observing Experts Observing' with Michael E. Lynch, 16-20 August, Ravenstein, the Netherlands

2009

"Invasiveness in the biodiversity debate: categories and standardized data in a wildlife network" at research seminar Forest and Nature Conservation Policy Group, 17 December, Wageningen, the Netherlands

About the author

Susan was born in the small town of Kwadendamme in the province of Zeeland, on a cold, snowy winter night in 1978. She was a bit small (and remained so), but there was too much snow to get to the hospital, so she was kept warm on the couch. She spent 18 years on and around that couch, going to school, playing outside, and collecting teddy-bears. She once tried archery, but mostly, when she was not in school, she spent her time reading books, playing with her parakeet, writing stories and playing in the 'woods' (a lane of two rows of trees with a bit of understory…). In the holidays she enjoyed hiking with her family in different countries in Europe, of which Switzerland, Ireland and Norway were her favourites. She came across 'smart' animals again, besides her parakeet, in high school during a biology project involving snails when on the first night of the experiment the snails escaped the glass box in which she had put them. Since she had marked the snails with distinguishing numbers on their shells she knew it was number five that she never found….Many, many years later the mystery was solved when her dad was re-organising the shed and discovered the shell of number five in a tool cupboard! After 18 years spent in that small town she travelled to the other side of the country to Wageningen to study Forest and Nature Conservation. She loved nature and wanted to learn more about it, but without cutting up frogs and pigs, as she would have to do if she chose to study biology. Big town Wageningen was an eye-opener to her but she soon found her way around on her distinctive bike which she had painted red and green with white flowers (Daisies). She loved studying trees, but she also loved studying wild animals in relation to natural processes. She therefore chose to do her first master's thesis on that subject at National Park the Hoge Veluwe, studying the effects of ten years of exclusion of large herbivores on the vegetation in forest and meadow in the park. Even before completing this research, she was already committed to moving forward in that area and particularly wanted to see the much praised 'natural ecosystem' of Yellowstone National park with her own eyes. So, she 'networked' herself into a traineeship at the Gardiner Forest Service just north of Yellowstone National Park, USA. It was here that she fell in love with bears again, real ones this time. She spent some heart stopping moments of anticipating an encounter with a grizzly or black bear, but in fact expended most of her time hiking around, looking for bear tracks to measure and bear poop to collect for further investigation. Processing the bear-data that had been assembled she found fascinating; the tracks were 'simply' entered in an excel sheet, while the bear poop was dried at the 'bunk house', the trainees' residence, and later processed in a food processor with a colleague from the forest service, finally to be sent to a laboratory for further investigation. This traineeship

was an important milestone in her life and career. After she returned to Wageningen she dedicated herself to exploring the breadth of Forest and Nature Management beginning by working on a MSc thesis in the area of communication and policy. Her subject was the examination of communities of practice as a new kind of collaboration in the countryside, specifically focussed on a multidisciplinary working method. Having succeeded, and after graduation, she knew two things for sure: she was determined to do 'something with bears' and she really wanted to do research or start a PhD project. However, nice in theory, practice told a different story. Instead, she went from bears to trees. She spend several years working variously as a tree consultant at a commercial business, for the municipality of Amsterdam writing a 'trash policy', and at the (former) National Tree Foundation coordinating their national network of volunteers. But the wish to conduct authentic research never really left her mind. After the job at the National Tree Foundation ended she was determined to move on to her future PhD.

When her husband had to spend time in St Louis, USA, she went there as well and went to meetings, spent time with researchers at all three universities in St Louis and became reacquainted with research topics in her area. For one and a half years she applied for grants and was invited for job interviews in locations as varied as Hawaii, Svalbard, Zurich, and finally, back to – well-known – Wageningen. Although, in the meantime, she had moved to Nijmegen, where she still lives. The Wageningen PhD-topic was a surprising, but perfectly fitting outcome. In that project she was able to combine her knowledge as a trained ecologist with the knowledge gained while working in a variety of policy settings. Although the original topic seems rather different from the thesis that finally emerged, there was enough space within the description of the topic to make it a perfect match. And what happened with the bears? The bears turned up again during her search to find a matching second case to pair with the wild boars. And here, surprisingly, even 'trash' came up again....

This PhD trajectory began in March 2009, when her oldest daughter was just 6 months old. It was a period of her research she experienced as both confusing and fascinating. She first became involved in a project called EBONE: the European Biodiversity Observation Network, where she conducted fieldwork during a project meeting in Aix-en-Provence. This resulted in an article and a book chapter, which are not part of this thesis. Her thesis would be focused on wildlife management. Conducting fieldwork for her thesis at the Veluwe and in the Rocky Mountains (to which she moved with the whole family for a few months), were very insightful periods which served to further shape her research. Another inspirational event in her PhD trajectory was the organisation (in 2012), together with like-minded

researcher Hanneke Nijland, of the seminar 'Interpreting the human-animal relation; Problematizing the integration of animals in interpretive research' with keynote speakers Timothy Pachirat and Dvora Yanow. Over the course of her PhD she also broadened her horizons by participating as a member of the WASS PhD Council and the WASS Education Committee. In addition she gave lectures in several courses at Wageningen University, supervised various BSc and MSc thesis students, and presented at various symposia and conferences. After her contract ended she had the opportunity to be a lecturer at the Forest and Nature Conservation Policy Group for almost a year. In that time she became better acquainted with lecturing, and she was also involved in coordinating the International Summer School 'Governing Landscape Restoration: Governance, Restoration, Privatization' for PhD-students, post-docs, and practitioners. This period was again one of learning and new collaborations, such as with Cora van Oosten from the Centre for Development Innovation (CDI-)WUR. But her PhD was still not finished. After this job ended she knew one thing was for sure: finishing her PhD must come next. And it did! Currently she is setting up her own busy-ness and will continue in her dedication to finding ways to promote human-wild animal cohabitation – which is not impossible.

Alongside academic life is the life of home and hearth. She and the love of her life are grateful for their four children who continually demonstrate to them the wonders of life. Raising them has already generated a lot of creative thinking, and created many joyful and priceless moments.

You may contact Susan at susan@bearatwork.org
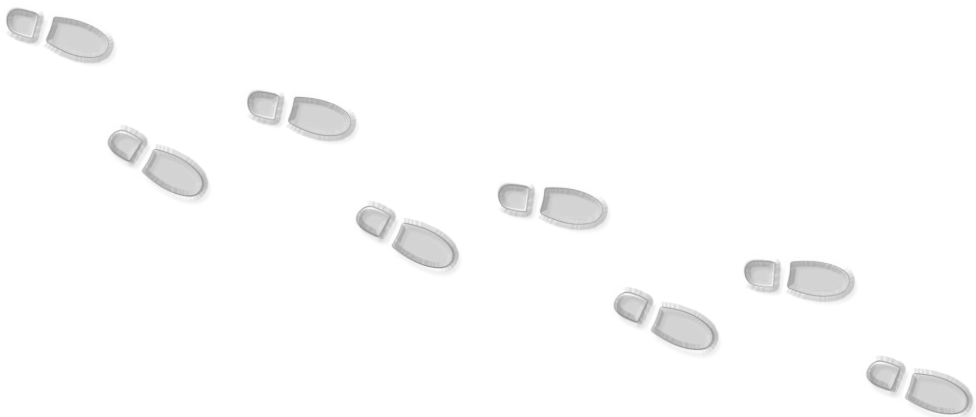
Acknowledgements

Once upon a time, there was a girl who lived in a village far away from the forest. When she was 18 she went away to study Forest and Nature Management. One day at the end of her study she was pondering about the idea of pursuing a PhD. *"That's a good idea"*, many said to her. So she went along looking for the best, most suitable research topic, while traveling through a diverse forest of jobs. *"Remember, pick a topic that really interests you"*, some said. *"Remember, it won't be easy"*, others cautioned. *"Just keep going, and don't give up"*, others supported her on the way to finding a topic and ultimately traversing the PhD-route. *"Don't worry, I will manage, someway, somehow"*, the girl kept saying. Although she came across some elephants in a room, and passed some hungry bears, she kept on going and the result is in this booklet.

"If you really want to pursue something: GO for it!"

This research would not have been possible without the support of my family, friends, and colleagues. First of all, they believed in me and encouraged me to keep pursuing my dream to start a PhD-project after I had worked for several years outside academia. And after that, when I was working on my research, they supported me when I needed it most. 'Thanks' doesn't say enough, I am truly blessed with all the people that stood by me.

First, I will thank Esther Turnhout. Esther, thank you for the many talks we had, especially in the beginning when I had to find my way around in a new discipline. Also thanks for your critical notes, which haven't always been easy to take but after a few good nights of sleep I could see how I could indeed better shape my argumentation by thinking through your comments. Thank you for providing me space to find my own way in conducting research. Also thanks, for your support during some difficult times, equally for celebrating the happy moments with me. I also want to thank Jan van Tatenhove for his encouraging comments. Jan, I always appreciated your pragmatic approach, and you made me think a lot about how to best articulate my standpoint in 'thinking with animals'. And I love your 'famous' final word, repeated after every meeting: 'success'. Gert Spaargaren, I want to thank you stimulating me to find my own personal vision in this research, so that it has become a 'Susan' research. Clemens Driessen, you made me see being trained as an ecologist as a qualification, as an advantage rather than a disadvantage, especially in the sort of research I was conducting. When I shifted to a new discipline with the start of this PhD research, I was – at first – confused, thinking that I would have to completely

abandon my ecological background and dive into the discipline of social science. But, in fact, I have had to embrace my ecological background including my work experience in policy settings from the very beginning. I also enjoyed the human-non human talks we have had. Michael Carolan, I want to thank you for the wonderful opportunity to conduct my fieldwork in Colorado, to make use of the facilities at Colorado State University and write one of the chapters together. Although we only met each other very briefly when I was in Colorado, I felt welcome in the department and was actually able to collect my research data in the relatively short period I was there. I also want to thank our Colorado hosts, Ron and Gail Baker, for letting me and my family stay in their basement-apartment in lovely Fort Collins. Our oldest daughter still remembers the cats and the neighbor's little wooden owls. And, she, as well as the rest of us, would love to return! We were there at a crazy time, because after about two weeks there were huge forest fires all around. It was in that time that I came into contact with Carol Burkett. Besides the lovely hike we had together in Roxborough Park, I remember your offer that if we needed to, because of the forest fires around Fort Collins where we were staying, we could move to Superior. Thomas Gootz, I am blessed with our contact when I was over there attending some meetings. Thanks for the lovely pictures of black bears from your place that cheer this thesis up.

I am thankful to Rob Jongman, Marion Bogers, Philip Roche and the other members of the EBONE-team (European Biodiversity Observation Network) for their cooperation and the opportunity it gave me to attend one of their project's meetings in Aix-en-Provence in France. Being a participant-observer at this meeting held at the very beginning of my research project contributed to helping me delineate the core focus of my PhD research. Although their project is not part of this thesis, it contributed to the writing of an article and a book chapter.

I am most appreciative of the grants I have received during my PhD trajectory. They have contributed to allowing me to do my fieldwork and to attend some conferences: ECPR Mobility Fund Award for Joint Sessions (2010), WASS Junior Researcher Grant (2010), Stichting LEB-fonds (2012), WASS Seminar Grant (2012), Storm van der Chijs Award for excellent female WU-PhD students (2013).

I also enjoyed working with all the MSc and BSc students I have supervised. Supervising the variety of your research topics, some of which related to my own research topic, also created a stimulating opportunity to reflect on my own research. As such I have experienced these supervisions as a two way learning experience. Special thanks to Bibi Lotte van der Horst, Axel Buijs, Anouk de Plaa, and Youri Jongkoen for joining in part of my project, traversing similar paths and challenges.

I have enjoyed the many conversations I have had over the years with all other like-minded human-animal or human-nature researchers. These conversations have inspired me in numerous and varied ways: Marjolein Kloek (one of my paranymphs), Hanneke Nijland (my other paranymph), Clemens Driessen, Harry Wels, Kelly Roos-Koutstaal, Marie-Jose Enders-Slegers, Jannes Eshuis, Theo Verheggen, Judith Floor, Hilde Toonen, Eira Carballo Cárdenas, Carolina Maciel, Jacqueline Bos, Michiel de Krom, Jur Koksma, Dhoya Snijders, Bernice Bovenkerk, Jozef Keulartz, Martin Drenthen, Glenn Deliège, Rob Lenders, Luuk Knippenberg, Astrid Bracke, Erwin van Maanen, Andrea Gammon, Mateusz Tokarski, Riyan van den Born, Sanne van der Hout, Eva Meijer, Christoph Janzing, Jelle Hilbers, Lise Nuninger, Arna Danklof, Yulia Kisora, Uta Maria Jürgens, Eugenie van Heijgen, Dvora Yanow, Timothy Pachirat, Noelle Aarts, Anna Lawrence, Ann van Herzele, Kris van Koppen, Mart l'Ami, Jamie Lorimer, Hayden Lorimer, Michael Lynch, Willem Halffman, Teun Zuiderent-Jerak, Annemarie Mol, Juha Hiedanpää, Geoffrey Bowker, Mara Miele, Julie Urbanik and many more whom I have met and spoken to about more-than-human topics over all those years. It is a topic that is getting increasing attention and many people are reacting to its importance, which I am very pleased to see. It will be an ongoing story. Let's keep narrating human-wild animal experiences.

Then there are the many colleagues from the Forest and Nature Conservation Policy Group (FNP) and the Environmental Policy Group (ENP). All of you have contributed to a vibrant academic life and the chance to share thoughts about our lives beyond academia during coffee breaks or walks. It feels only fair to (at least try to) name you all, although some of you are not working in these groups anymore. From FNP, I first want to thank my roommates over the years: Jilske de Bruin, Severine van Bommel, Sonja van der Arend, Fabio Homero Diniz, Charlotte Benneker and Peter van Gossum. All of you made it fun to share our thoughts and we all tried to make the room look nice, although the plants were not always too happy. Furthermore thanks to: Bas Arts, Esther Turnhout, Birgit Elands, Freerk Wiersum, Arjen Buijs, Jim van Laar, Marleen Buizer, Mirjam de Groot, Marjanke Hoogstra-Klein, Jelle Behagel, Hens Runhaar, Barbara Kolijn, Carla van Zwaaij, Audrey Raijmann-Schut, Keen Poon, Mieke Hannink-Peeters, Jilske de Bruin, Joana Bezerra, Jessica de Koning, Marieke Meesters, Danielle van Oijen, Verina Ingram, Ingrid Visseren-Hamakers, Geerten Hengeveld, Wolfram Dressler, Tabitha Muriuki, Rutger de Jong, Robert Ochieng, Margreet Brinxma, Thomas Mattijssen, Irene Bouwma, Kim Phung Dang, William Cook, Wiebren Kuindersma, Cinthia Soto Golcher, Albertina Ndeinoma, Thi Kim Phung Dang, Wiepke Wissema, Alemayehu Ayana, Purabi Bose, Sailaja Nandigama, Rikke Arnouts, Ramona van Marwijk,

Eshuis. And thank you for inviting me to join a barbeque with fellow human-animal PhD candidates from your university at your lovely home.

Others who made my PhD-period vibrant and contributed to a broader understanding and committed membership of the WASS Graduate school, were my fellow WASS PhD Council members Willem Rijpkema, Daphne Verreth, Els Bilman, Gohar Nuhoff-Isakhanyan, Muriel Verain, Jannette van Beek, Geralda Hop, Iulian V. Barba Lata, Nidhi Gupta, Evelien van de Veer, Carolina Maciel, and Sanne Middendorp. And the members of the WASS Education Committee, which it was a pleasure to be part of: Martin Mulder, Stefan Wahlen, Eveline Vaane, Petra Roodbol-Mekkes, Liesbeth Dries, Jannette van Beek, Peter Oosterveer, Heleen Danen-Louwerse. In fact I want to thank all the people at the WASS Graduate School: Marcella Haan, Esther Roquas, Heleen Danen-Louwerse, Fennie van Straalen, and former members Dries Hegger, Stefan Wahlen, Maartje van de Velde, and Eveline Vaane.

Besides working on my thesis, I also enjoyed putting the topic of my research on the (public & scientific) agenda, both as a learning opportunity, as well as to raise a debate about 'more-than-human' topics. I would like to take a minute to address two events that I found particularly satisfying as well as challenging to co-organize. First, the organization of a debate about the return of the wolf in the Netherlands (in Dutch): *"Return of the wolf in the Netherlands: Gain or Trouble"* together with Rural Wageningen (RUW) Foundation, specifically Aniek Hilkens and Sjoerd Haitsma, and WSBV Sylvatica, specifically Simone Loohuizen, as well as Jelle Hilbers and Christoph Janzing, and the invited panel. The debate was a success. I co-organised another event, a WASS Seminar, together with Hanneke Nijland: Interpreting the human-animal relation: Problematizing the integration of animals in interpretive research'. I thoroughly enjoyed the creative thinking that went into the set-up of the program, and the fact that we were given the opportunity from WASS to organize it with invited keynote speaker Timothy Pachirat and host of the day Dvora Yanow. Both of them challenged me to think critically about my methodology, for which I am thankful. Hanneke, organizing this event was the beginning of an academic and personal friendship. I look forward to another opportunity to work with you in the near future!

I very much appreciated the chances I was given to present at several conferences and to pitch at the symposium of the Dies Natalis 'Fascinating Nature' of Wageningen University. The 'contest' preceding selection for the pitch, as well as the thorough preparation given by Janou Hemsing about pitching at the Dies Natalis was quite a challenging as well as a 'fascinating' learning experience.

Thanks, Gert, Esther, Bas and Jan for supporting me in joining in the pitching contest.

I owe a great deal of gratitude to all my respondents in Colorado, USA and the Veluwe, the Netherlands. Although I can't name each and every one of you individually, because I promised anonymity in my research, without your effort this thesis would not have been possible. The many field visits, the lively conversations, the times you showed me 'how things are done', and 'how to recognize animal writings', were not only extremely valuable in an academic sense; it was a pleasure for me to be part of your daily work and experience the passion, energy, devotion and also the frustrations that go into 'living with' wild animals.

Having said that, I also owe thanks to the wild animals themselves for being around and raising our attention in whatever way they could. We – humans – need to keep on find ways to listen to and to find ways to live together.

"Pursuing might be tough, however, never give up and ask help"

I want to take some space for Jürgen Böhmer to thank him for his support in pursuing and also helping to create a possible PhD position for me. I remember the fun we had and our thoughtful conversations, and especially the creativity you used to find me a place to stay in Munich. Thinking about Hawaiian pigs and also your support for me to attend two summer schools, one in Bialowieza, Poland and one in Frauenchiemsee, Germany, contributed considerably to my determination to find a fitting PhD position. Although, in the end, they were not Hawaiian pigs that entered my research, but Dutch ones, I owe thanks to you for your belief that I would succeed, somehow, somewhere.

Doing a PhD is not a lonely journey. I have experienced that working together, sharing thoughts and reading each other's progress and most of all helping each other in pursuing research, although working on very different topics, can prove to be extremely motivating. All these things contributed tremendously to making it a far from lonely adventure. As such, special thanks to my writing buddies along the way: Saskia van Pelt, we shared our initial struggles in the early stages of our projects. Our intervision meetings were very useful in fine tuning and helping us to find our ways in our respective projects. Also thanks to Carla Takaki Richardson from California, USA. We met each other online, we had contact through e-mail and shared our texts during one year (summer 2013-summer 2014). The intention was to share and get each other through the summer of 2013, but we found that we were a match and extended that period. Unfortunately we have never met in person. Also Eira Carballo Cárdenas, Judith Floor, Jacqueline Bos and Marjolein Kloek, I am

thankful for the writing support, the feedback on drafts, sharing our doubts, our progress, our successes and all we shared over the years. Eira and Jacqueline, I am confident you too will succeed, and I will be around to support you through those last stages! Hanneke, we have shared many research related, and totally non-research related subjects; you inspired me and have been my sparring partner. When writing simultaneously we were in sync to keep each other motivated through difficult times, to keep each other going and celebrate our successes. I also owe you many thanks for editing my thesis! Rebekah, I first need to thank you for all the minions and unicorn humor that flew around the chat box and kept us motivated and laughing while struggling with our texts. But even more than that, I need to thank you for all the support of working together, during daylight and evening hours, as well as in the weekends. It has been far from lonely working on those last stages. We motivated each other, shared our victories, and I cherish our long-lasting friendship. And I will keep supporting you with more of those funny humor pictures and quotes to get you through your Viva. And, not to forget,…our balloon flight is waiting for us! Although it has been more than 10 years since we agreed that 'one day' when we had both finally finished a PhD (we had not even a project at that time), we would fulfill a dream: going for a balloon flight together! We will have that flight in the near future, how cool is that!

Besides these great writing buddies, I also want to thank Henk Hogeveen for being my mentor as part of a WASS-mentoring program, and for our informal chats about academic life. And I want to express special thanks to Harry Wels for our yearly 'catch-up' meetings and in-between contact about our common interest in human-animal topics, whether in Africa, the Netherlands or the USA. We've shared many book suggestions, you've introduced me to new fora and told me about interesting meetings, and you've been a sparring partner in so many different fields. You have inspired me also about how to go on when my thesis has been completed. I am already looking forward to the next catch-up meeting!

Last, but not least, I have been honoured to be paranymph at three great friend's promotions: Menno Mandemakers, Marjolein Kloek and Hanneke Nijland. With all of you I have shared the intense and satisfying PhD-life, and celebrated many beautiful moments.

"A lively academic life and a lively private life!"

Academic life is one part of my life, but I owe so much gratitude to all my dear friends, relatives, the volunteer groups I participate in (IVN Groen en Ruimte, Rijk van Nijmegen; OC Spoenk, Meander Vrijeschool voor basisonderwijs, Neij West),

or have participated in (Vrienden van de Veluwe), and all the other people who make and have made this academic accomplishment possible. But most of all I feel blessed for just having all these wonderful people in my life. It will be impossible to name you all; however, a few need particular mention, because their intense entanglement with this PhD-journey of mine has been so heart-warming.

Marjoleine, Rebekah, Geertruida, Jetteke, Severine, for your lovely friendship, support, for the relaxed lunches, tea-breaks, walks, catch-ups and the beautiful memories we made together. Marjoleine, thanks for the 'campus-walks' and chats. When they were needed you always had simple, clear questions and answers. Making a mind-map together was not only fun, it was also very insightful. Rebekah, we have hardly seen each other these years, both working on our own theses, you in Edinburgh, Scotland, but – luckily – you had many visits 'back home'! Our friendship cannot be described in words. Sometimes words are not needed at all. Geertruida, also with you I have that kind of special relation where words are not needed, and after years of hardly seeing each other, we know our connection will not fade away. And…also with you I have a promise to fulfill. Jetteke, well, in fact also Imke and Alies: Never a dull moment at Tivoli, Berg en Dal! At those moments, as well as the traditional Sinterklaas 'tour' in Nijmegen, or in fact 'bus tour', it was impossible to think one way or another about my PhD, which was a good way to relax. Severine, without your advice I would not even have applied for this PhD position! We had both professional and personal conversations throughout and I hope that will never end, even though you will be traveling all the way to Australia! I admire your dedication and your honest feedback. It is a pleasure to write a book chapter with you which is forthcoming. I will miss for sure my walks to the fourth floor at the Leeuwenborch just checking to see if you would be around for a cup of coffee. Marjoleine, Jolke, Geertruida, Gerlof, special thanks for your help with transcribing. Ramon, I remember so well the time you came by as a surprise and brought me a beautiful painting with black bears from Moscow! I still look at it every day. Corina, you have been my best friend since high school and I cherish all our conversations about difficult and easy things. Christien, Mark, Nora and Koen I will never forget the fun times at the farm and the sharing of many topics. Making your own bread is what we learned from you. Henri Kerkdijk, thank you for the interesting conversations we have had about protecting wildlife and ecotourism as a way to contribute to protecting them. Let's continue those. You are setting up a great business! Alex, thanks for the variety of cultural activities we have undertaken over the years, but especially 'Stukafest' (theater, comedy, dance, and music performances in student rooms across Nijmegen), during which we felt 'young' again. It has been such fun to be surprised by up-and-coming talent. Bea, I thank you

for all our conversations about nature in its broadest sense, in and around Nijmegen. And for providing the space I sometimes needed to juggle volunteer work and finish PhD-work. Aleta, Bert, Rob, and Leonie it has been and still is a pleasure to write about nature in urban settings for the local magazine of Nijmegen-Nieuw West (Neij West). Ria, thank you for providing the possibility to write for the Nieuwe Veluwe, and by doing that stimulating me to write in a popular, non-scientific, style.

Frances, where to start? You have been my English anchor during most of my PhD trajectory. You have read so many of my writings and corrected them, you gave suggestions, and my text went back and forth if we thought we didn't understand each other correctly. It has been a pleasure and a valuable learning experience for me. I owe you so much gratitude for your dedication and always supportive thinking along with me. You always found ways to help me next to your already busy life with your own children and grandchildren. So, thank you for your offer to be my English mentor along the way.

Gerlof, where shall I begin to thank you? You made it possible for me to keep going, especially the last half year. Without all the time you invested over the years to help with the kids and pick them up from school it would have been very difficult. Without your help it would not have been possible to dedicate enough time to succeed in the last stretch of my PhD. Besides that, it is always nice to share the ideas we both have about wildlife. And of course to laugh a lot with the kids! And thanks a lot for letting me use some of your fantastic wild boar pictures in my thesis.

Aleta, we met each other through the magazine Neij West (formerly known as "Partituur"). Each and every time it was a nice surprise to see how you turned my unadorned text into two full color pages with pictures of trees, ants, wasps, worms, no matter what the subject was at the time. But most of all, it has been such a great pleasure to create my cover, especially the footprints, together with you 'step by step'. This is a beautiful gift and provides the finishing touch to the text inside. You let me see how well you understood what I meant to say by turning it into a visual. That is what I call creative art.

Talking about creativity, the cartoon would not have been there without the understanding of Lodewijk which is expressed on the front cover. Thank you very much for your dedication to finding a way to express 'cohabitation', with a wink!

And life doesn't end with pursuing a PhD. Besides all the words of thanks related to this research, I am grateful for the warm support of Joost, Hanneke, Rebekah, 'buddies' Evelien and Hanna, and 'down to earth and straightforward' Joyce, and so many other entrepreneurs I have met while exploring the ways in which

I can proceed and discover the wonderful insights of entrepreneurship and shape my entrepreneurial skills (which, in fact, are also very useful in academia). Without all of you I would not now have my own business. Of course, alongside this I will keep on devoting time to finding the ways in which I might contribute to the pursuit of cohabitation through research or …

Dear dad, and dear mom – whom I wish could still be here – thank you for all your support in everything I've done and thanks for all your priceless help, help that made it possible for me to accomplish what I wanted. And then my dear brother Marc, and my dear sister Annemieke – whom I wish could also still be here – I am the third who traveled the PhD road. Both of you have inspired me in so many different ways. Dad; Marc & Penny and canines Folco (✝), Vigo, Izmir, Madoc; Roel & Gina and Tim, our yearly family-weekends in spring were fun and relaxed get-togethers in all of our busy lives. Dear Gemmie & John, thank you for your listening ears, for your support and for all the days you took take care of the kids and had fun with them while I could work. Ingrid; Ingeborg & Freek, Sanne, Koen, thank you for many relaxing moments and for being my extended heartwarming family.

To all the people from daycare, after-school care, and school who took care of our kids when we were at work, just thanks for the little presents, drawings, paintings and most of all the happy faces when they came home and told their lively stories of the day. It is thanks to the school that they sing the loveliest songs together!

Dear Joost, I can't find words to express how grateful I am to you for having given me the opportunity to explore and ultimately find a way to pursue my dream to do research, especially my determination to find my way back to academia after several years of different jobs outside the university. You knew exactly what I needed. Thank you for making it possible for me to make that career shift, especially to continue to pursue it when our first baby girl was on her way. We have had some rough years here and there due to a variety of circumstances beyond our control. You were and still are my tower of strength. At times it was far from easy, especially the last months when you took so much of the parental care on your shoulders during the evenings and weekends. But you believed I would succeed, you saw the ending when I struggled on the way, you knew when to give me space when I needed it most. Our holidays were sacred moments, full of crazy and quality time together with the kids. Without your unconditional support and parental care for our four kids, this thesis would have never been completed. And with that I come to those three, sweet, amazing, and incredible lovely daughters and our toddler son, who all knew exactly when to cheer me up – or sometimes acted like a mirror of my mood. Overall, Mariska, Eline, Charlotte and Julian, you are just amazing. I learned a lot from all of

you, about myself, as well as how wonderful the world is: observing coots with Mariska just across from our home, reading lots of books together with Eline, drawing funny creatures with Charlotte, and being delighted and enthusiastically waving to all busses and ships passing by with Julian. Just to name a few small things. I am extremely thankful for your patience when 'mom needed to work again' in the last part of my writing. My workplace at home would not be a fun place without your drawings, creative endeavors, and 'just' you being around and letting me know when to step away from thinking too much, to be practical, laugh, love and have fun. And talking about fun… you know, I promised quality time with all of you, to enjoy, laugh, have fun and just dive into a fairytale world and create more of those memories I cherish: Efteling here we come ☺

"Never stop following your dream(s)"

Susan

Colophon

About the cover: The cartoon on the cover illustrates that both human and wild animals should be considered as participants in (rethinking) wildlife management practices as discussed in this thesis. The cover also illustrates the two case studies that form an important part of the research: black bear management at the Colorado Front Range, Colorado, USA and wild boar management at the Veluwe, the Netherlands. Additionally, the cartoon illustrates that wild animals learn as individuals (the sole black bear), and as collectives (the two wild boars), which refers back to the understanding of mindedness discussed in this thesis. And of course, the cartoon is a wink at 'cohabitation', which certainly does not have the intention to be anthropocentric and does not propose that humans and wild animals should live side by side in domesticated companionship. On the back the tracks of black bear, wild boar and human illustrate one sort of multisensory writing and reading. And finally, the way the tracks are drawn refers to the theme of this thesis: moving from separation towards living together.
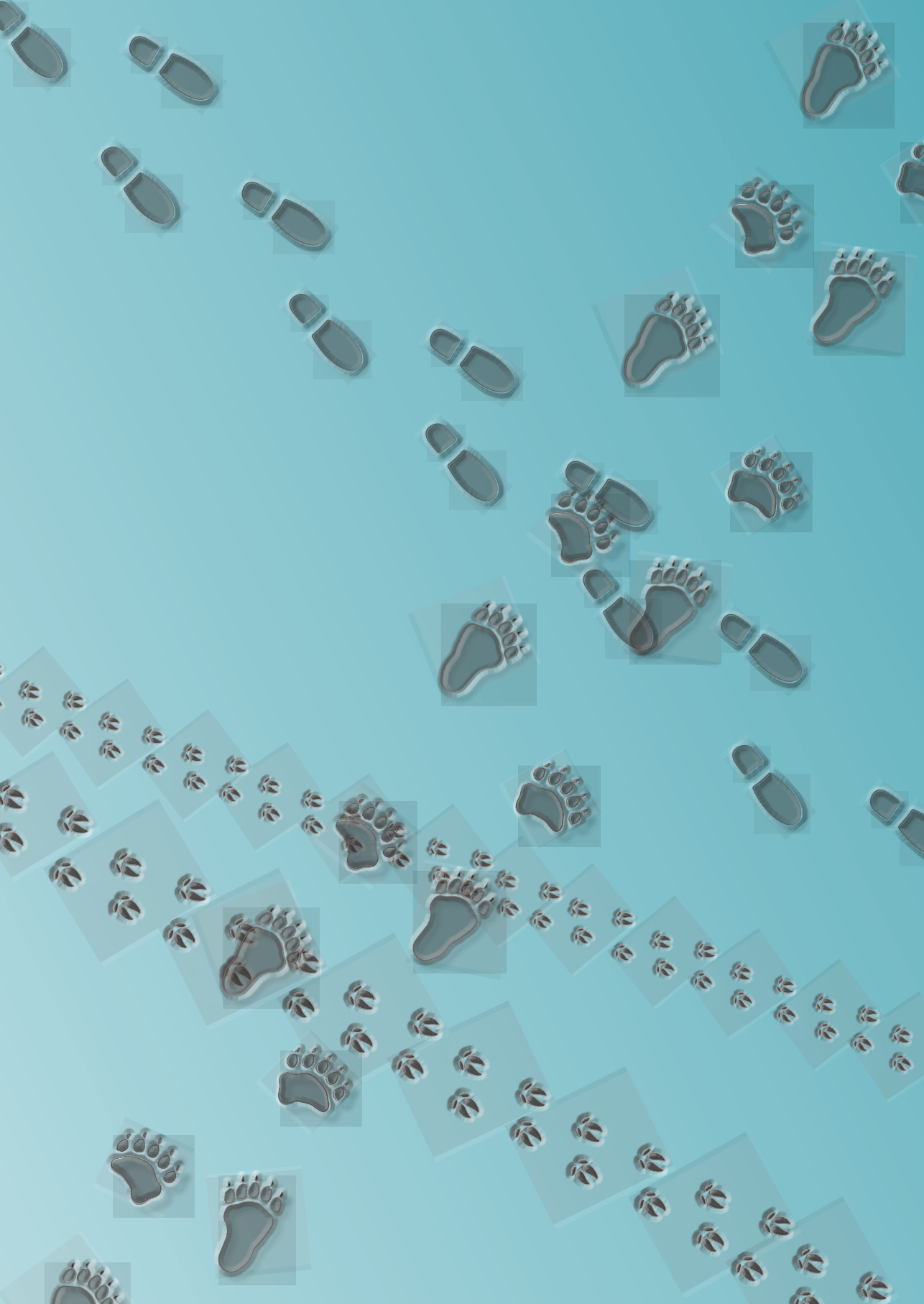
Propositions

1. Managing nuisance animals requires disciplining nuisance people.
   (this thesis)

2. Living together with wild animals implies a de-Disneyfication of nature.
   (this thesis)

3. Eco-tourism frustrates the 'wildness' of wildlife.

4. Being a novice in a new discipline resembles being a wild animal entering a human populated area: we learn, we adapt and we resist the – hidden – codes of conduct.

5. Science keeps up a breastmilk paradox: promoting breastmilk but failing to allocate private space for breastfeeding at conferences.

6. PhD supervision demands a mutual affective process and reflection on part of each co-participant.

Propositions belonging to the thesis, entitled

'Rethinking Wildlife Management
Living With Wild Animals'

Susan Boonman-Berson
Wageningen, 21 September 2018