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# Infrastructure as biopolitics: Fencing, categorizing and valuing animals for wolf conservation in Germany

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ABSTRACT

This paper takes a critical look at biopolitical practices under the current regime for wolf conservation in Germany. One profound difference between human and more-than-human biopolitics is that it concerns multiple, more-than-human bodies, demanding a close examination of governance practices aimed at enabling conservation. My core argument is twofold: first, I argue that conservation policies in Germany attempt to frame wolves as collectivities and apply a population perspective on these animals. However, the very technologies that aim to monitor wolves as population, namely genetic analyses, also produce individual wolves that complicate conservation efforts due to their affective force (Lorimer, 2015). Second, as active wolf management in the form of population control is rare due to legal regulations, there is a strong focus on livestock protection measures. These infrastructuring practices (Barua, 2021) continue to fail because they rest on the idea that convivial coexistence can be quantified and ignore that technologies such as fences can alter animals' atmospheres (Lorimer et al., 2019) profoundly. As a result, infrastructuring practices aimed at enabling coexistence may run counter to their initial purpose. With fences becoming habitats, lively and discursive multispecies relations are renegotiated.

## 1. Introduction

Wildlife conservation continues to be a global model for maintaining the earth's biodiversity in a time of ecological crisis. Conservation projects differ in their perceived urgency; while some species need to be protected from extinction for their intrinsic value or their ecological function, other species are reintroduced for landscape conservation, natural forest rejuvenation or because of their symbolic status. In either undertaking, conservation follows certain obvious or less obvious biopolitical practices, which determine how humans make sense of the more-than-human world and who is to live or let die (Biermann & Mansfield, 2014). Various scholarship has been attentive to aspects of the more-than-human biopolitics of wildlife conservation (Asdal et al., 2016; Biermann & Anderson, 2017; Hodgetts, 2016; Lorimer, 2015; Srinivasan, 2014). Taking the example of wolf conservation in Germany, this paper attempts to further the debate on conservation biopolitics by closely examining biopolitical practices for wolf and livestock protection measures in Germany. In densely populated Germany, conservation takes place in co-inhabited, more-than-human landscapes. Monitoring wolves for the European Union, infrastructuring wild and farm animals with fences, and quantifying animals' risk and value in statistical tables has repercussions on the modes of coexistence (Buller, 2008).

Wolves have made an impressive comeback to German landscapes since the fall of the inner-German border in 1989. After becoming nearly extinct within Germany, they have been protected by German, European and international law for more than two decades now. Today, an estimated number of 2000 animals have settled in packs, pairs and as individuals predominantly in the country's Northern and Eastern provinces. However, the population does not yet meet the requirements for a "favourable conservation status" (FCS) as demanded by the supranational EU (Council Directive 92/43/EEC, 1992). Indices that measure the FCS consider population dynamics data and the condition of the habitat. The strict conservation status precludes wolf killings and puts the focus on livestock protection measures. The conservation status has become the center of emotional and polarized debates across various societal groups.

This paper aims to expand the scholarship on conservation biopolitics. I argue that one profound difference between human and more-than-human biopolitics is that it concerns multiple, more-than-human bodies, demanding a close examination of governance practices aimed at enabling conservation. This is in line with Biermann and Anderson's (2017) observation that conservation biopolitics do not only intervene on a population level, but discipline individual animal bodies. This can profoundly alter the lived geographies of farm animals, wild animals and

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humans. By adding scholarship on more-than-human infrastructures (Barua, 2021; Blok et al., 2016; Martin et al., 2021) to the debate, this paper attempts to broaden the analytical framework of conservation biopolitics.

In the first section, I discuss more-than-human biopolitics and focus on two distinct, yet interrelated aspects: the complicated relationship between animal individuals and populations in conservation management and the "affective force" (Lorimer, 2015) of certain species. Building on Srinivasan's research on the "ontological construction" of animals as collectivities and its consequences for the social formation of conservation (Srinivasan, 2017, 1468), this paper considers the role of practices of individualization and generalization (enabled by technologies such as genetic analyses) for conservation decisions and engages with emerging biopolitical categories (i.a. hybrid, pure). Wolves are framed as collectivities, however, their non-human charisma (Lorimer, 2007) and certain technologies allow for an individualization. Drawing from animal geographies, I show how this complicates conservation policies.

Moving away from a population perspective, the second section turns to the materiality of conservation biopolitics. It examines infrastructures that aim to provide a convivial coexistence with wolves at the lowest possible risk. Building on recent work on more-than-human infrastructures (Barua, 2021; Blok et al., 2016; Martin et al., 2021), I understand livestock protection measures as infrastructuring practices embedded in conservation biopolitics. As infrastructures, they participate materially and discursively in convivial landscapes. They become mediums of life (Barua, 2021, 1473), create new habitats and affect individual animal bodies. Infrastructures can also shift distributions of risk and value between domestic animals, wild prey animals and wild wolves in pasture feeding settings. It is therefore important to examine how governance in the form of fence heights, damage statistics or kill rates determines the modes of coexistence.

My core argument is twofold: I argue that by governing wolves on a population level, the strict translation of FCS regulations into conservation biopolitics in Germany facilitates polarized conflicts. Wolves' "affective force" (Lorimer, 2015) and certain monitoring technologies allow for an individualization of the otherwise generalized animals, creating challenges for conservation. Solution approaches in the form of infrastructuring practices continue to fail because they rest on the idea that convivial coexistence can be quantified and ignore that certain technologies bring about profound socio-ecological changes in rural landscapes and alter animals' atmospheres. As a result, infrastructuring practices aimed at enabling coexistence may run counter to their initial purpose. With fences becoming habitats, lively and discursive multispecies relations are renegotiated.

By bringing the concepts of more-than-human infrastructure (Barua, 2021; Martin, 2021) and biopolitics into conversation, I understand this paper as an expansion of existing perspectives on conservation biopolitics. Infrastructuring practices become conservation biopolitics by modulating habitat.

The paper is based on ethnographic research conducted with livestock keepers, state officials, conservation geneticists, conservation NGOs and forest rangers since 2019. While it focuses on the provinces of Lower Saxony and Brandenburg in Northern Germany, it also discusses the interlinkages between provincial wolf management and monitoring on the one hand and conservation policies by the federal state on the other hand. Conflicts over the practices and technologies aiming to measure the official criteria for determining the wolves' conservation status are the starting point for my analysis. With a focus on infrastructures, it was important to include different fencing practices and landscape settings: pastures along river and sea dykes, pastures for sheep, horses and cattle as well as stationary and mobile fences. Shepherds easily invited me to work with them and teach me the basics of herding and fencing. In some regions, there were strong and polarized positions on wolf conservation. This made it sometimes difficult to meet people who were openly in conflict with each other. For example, I was working with both a shepherd and a government official, whose conflict was covered by print media and local television. It was challenging to gain their trust to be able to do fieldwork with both of them. However, these situations were also fruitful for my research as they highlighted the prevailing mistrust between different actors and most of the time, people were interested in discussing these issues.

Germany represents a special case in the context of the European wolf reintroduction as it is one of the very few countries that upholds the strict conservation status and where (legal) wolf killings are rare. Most other European countries limit their populations (for Scandinavia, s. Sandström et al., 2015, for the Iberian Peninsula s. Trouwborst, 2014) or limit the wolves' "rights" within so-called human territory (for Switzerland, s. Schröder & Steiner, 2020). However, as studies show, illegal hunting is also a widespread practice in these countries (Caniglia et al., 2010; von Essen et al., 2018).

## 2. Conservation biopolitics: calculating and reporting for a 'favourable conservation status'

In an ongoing debate, scholars of geography and related disciplines address biopolitics of conservation. Bringing Foucault's work on the production of knowledge and the exercise of power (Foucault, 2003, 2007, 2010) in conversation with animal studies/geographies, scholars have, among others, discussed practices of subjectification (Hodgetts, 2016), of care (Srinivasan, 2014), of (back-)breeding (Braverman, 2014; Hennessy, 2013; Lorimer & Driessen, 2013), of biopolitics as biodiversity (Lorimer, 2015, 58ff), of violent othering (Shukin, 2009; Taylor, 2013; Wadiwel, 2009), of state-making (Loo, 2011; Rutherford, 2013) and of knowledge production in conservation sciences (Biermann & Mansfield, 2014). This scholarship on more-than-human biopolitics has provided a remarkable expansion to the concept of biopolitics (and biopower). Biopolitics, I argue, continues to provide a fruitful framework to develop a critical perspective on the socioecological conditions of rewilding and conservation - even more so against the backdrop of a growing digitalization and quantification of conservation, where the relationship between the locus of conservation practices, analyses and decisions still seems underresearched (Adams, 2018). Following Braun (2007), Hodgetts (2016) and Srinivasan (2017), biopolitics is a concept to understand how animals are managed (and conceptualized) on a so-called population level for the matter of conservation as well as how they become knowable through technologies. In this sense, conservation shapes "future worlds through the operations of assemblages of scientific knowledge, administration and practice" (Lorimer, 2015, 6). Biopolitical practices categorize animals in unsuspicious (=wild, normal and desirable), hybrid or problem wolves and attempt to govern convivial conditions with the help of legal regulations and statistics. As Biermann and Anderson (2017) point out, it is also important to understand how biopolitical practices govern and affect individual animals. While conservation generally targets animals at a population level, individuals are compared to "ideal types" (ibd., 6). If individual animals deviate in their genetics, morphology or behaviour, they become hybrid or impure and their life is deemed less valuable from a conservationist point of view (Fredriksen, 2016). Srinivasan's research on turtle conservation in Odisha reveals further nuances of the tension between caring for individuals or collectivities. It shows that human ontopolitics for animals differs between species (Whatmore, 2014). Killing or taking into account harming an individual wild animal could be interpreted as helping the population survive, while harming individual domestic animals is problematic. Still, both cases concern individual animals. This raises questions for the study of human-animal relations and demands to carefully examine the ontopolitics at work in conservation projects. Animal geographies have pointed to the role of non-human charisma (Lorimer, 2007; Monsarrat & Graham, 2018; Poerting & Schlottmann, 2020) and the "affective force" (Lorimer, 2015, 39) of certain animals. What is charismatic, is often viewed as worthy of protection. Charismatic animals, such as elephants, tigers, giraffes or other large

mammals, "are the culturally defined wild animals that many urban people encounter in their lives and come to care for" (Pooley et al., 2017, 518). Wolves are charismatic animals in Germany, albeit generating contradictory affects of awe and fear.

In the following section, I focus on the biopolitical practices of wolf management in Germany, where the complicated relationship between focusing on individual wolves on the one hand and a population perspective on the other hand is reflected in ongoing legal and societal debates. I identify two main biopolitical practices: the legislative framing of wolves as collectivities and the translation of wolves into measurable categories. First, I discuss how wolves are made on a population level. On a European level, wolves are framed as collectivities and the condition of the population defines their conservation status. Secondly, I discuss what happens when the very monitoring practices that aim to measure the population's health, i.e. genetic analyses, allow for an individualization of wolves.

### 2.1. Framing wolves as collectivities

Debates about the conditions of convivial relationships between wolves, humans and domestic animals continue to spark emotional and polarized conflicts in European countries. According to the Nature And Biodiversity Conservation Union (NABU), one of the largest environment associations in Germany, there are currently 128 packs, 35 pairs and 10 territorial individuals roaming the landscapes (NABU, 2021). Wolves are elusive animals in Germany: while on the one hand, most provinces with wolf presence have a monitoring and management plan available and the Federal Documentation and Consultation Centre on Wolves (DBBW) regularly publishes updates on wolves and their territories, the publicly available information remains vague (DBBW, 2021a). Vagueness can be strategic: conservationists fear that more detailed information on the animals and their suspected whereabouts could lead to more illegal killings or aversive conditioning (which is illegal in Germany).

Wolves are a protected species under the Habitats Directive of the European Union (Council Directive 92/43/EEC, 1992; Annex II, IV and V). Within this central biodiversity conservation legislation, the FCS is a key concept for European Union member states to organize the reporting and monitoring about their national wolf populations. Nation-states continue to be the most important category for estimating the conservation status of species, despite animals' mobilities that transgress state borders in various ways. Various actors have pushed the European Commission and/or nation-states to foster multinational monitoring and information exchange and make the data publicly accessible (Linnell und Boitani, 2011). At present, however, nation-states remain the reference frame for assessing the conservation status. According to the Habitats Directive, a conservation status of a species is favourable when:

> "population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and — the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and — there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis" (Council Directive 92/43/EEC, 1992).

Translating the concept into conservation policies in the respective member states, it means that monitoring remains important and active management (e.g. in the form of hunting) is only possible when the favourable status is ensured. To make the FCS measurable, Linnell and Boitani (2011) have developed so-called favourable reference values from the perspective of conservation biology: three criteria for the favourable reference population as well as three criteria for the favourable reference range (Linnell & Boitani, 2011). Calculations not only consider the present, but also integrate the past and expected future of wolf populations in their estimations. Which wolves are counted as part of the population is still a matter of debate, but most countries count adult individuals. As the comparison with other countries shows, determining the FCS and, consequently, deciding over lethal control, is a matter of interpretation (Epstein, 2016; Steeck, 2010; Trouwborst et al., 2017). For example, Sweden and Finland use so-called "controlled hunting" to keep their population of wolves at a maximum of 300–500 animals (Sandström et al., 2015). As Mitchell (2018) has shown for the case of Sweden, this comes with a large monitoring apparatus, making wolves very "visible" and thus measurable and manageable.

The most important technology for managing wolves at a population level is genetic monitoring. Genetic samples comprise, among others, scat, hair, saliva from killings or remains from dead wolves. Genetic monitoring is not only important for understanding the composition and origins of populations, but also because wolves can hardly be distinguished by their looks. This makes genetic analyses necessary for knowledge production and control. However, livestock keepers and other experts criticize the outstanding importance of genetic evidence, which is a requirement for receiving compensation for dead livestock or subsidies for protective measures such as fences, but also entangled in lengthy bureaucratic processes. In addition, the quality of genetic analysis continues to be the starting point for conflicts: occasionally media-hyped, there is a debate over the state of hybridization of grey wolves with domestic dogs in Germany (s. Dufresnes et al., 2019 for similar debates on the Alpine wolf population) as well as the integrity of the institute officially commissioned to conduct the genetic analyses. "Keeping wolves the right kind of wolves" (von Essen & Allen, 2015: 85) is an important biopolitical practice. Media reports often associate hybrids with aggressiveness and less shyness towards humans. Even though there are no signs of hybridization within the German wolf population, the idea of wolf-dog-hybrids continues to be a starting point of (public) mistrust in wolf management.

A similarly important biopolitical practice for framing wolves as collectivities is the translation of wolves into categories and numbers. Statistics enable control and fixation by categorization, allow for the formation of animals as populations and make assumptions and forecasts based on generality (Dillon & Lobo-Guerrero, 2009). German national statistics for wolf conservation do not differ much from human population statistics. There are statistics on spatial distribution, reproduction rate, population development or causes of death. In contrast to digital and molecular technologies, statistics in the context of wolf conservation depict animal life in bar charts, where conservation failure or success is calculated by a high number of living wolves and a low number of dead livestock. Statistics are based on information that is hierarchized according to SCALP[1] criteria. This means that some parts of the data collection are decentralized, but knowledge production is centralized. For example, anyone can enter wolf or track sightings, scat findings or sound recordings of wolves into a public mobile app in Lower Saxony. However, the grading of the quality of the data is centralized. SCALP criteria differentiate between C1 (clear evidence), C2 (confirmed hint), C3 (unconfirmed hint), False report and "assessment not possible". According to pastoralists, the category "false report" is problematic. One of my interview partners, a cattle farmer, gave the example of a calf that had been preyed in the pasture. When he found it in the morning, he called an official, who only arrived the next afternoon to collect genetic samples. The official confirmed that the forensics of the "crime scene" looked as if a wolf had killed the calf. However, because no genetic evidence of wolf was found, the case counts as "false report". The farmer suspects that the sampling had been contaminated due to the long waiting time and the rainy weather, leaving no genetic traces of the original perpetrator. From his perspective, the *de facto* processes of the monitoring system are problematic for two reasons. First, officials often arrive late to examine killed livestock, making it almost impossible to identify the perpetrator and produce reliable data for provincial or federal statistics. Second, he considers the category "false report" as

[1] "Status and Conservation of the Alpine Lynx Population".

suggestive, putting blame on him for no good reason.

There are more cases of multispecies encounters that defy a population-level statistical categorization for damage statistics. Farmers criticize that current damage statistics only depict a fraction of livestock dying due to wolves. One example are sheep that trampled each other dead in the stable. The shepherds had eye-witnesses to confirm that wolves had thrown the sheep into a state of panic, but the lack of a wolf's genetic evidence made compensation impossible. Other examples are sheep stillbirths and ewes dying of stress after a wolf attack. In another instance, a mother cow died of a sepsis a few days after wolf had bitten her in the head while she was defending her calf.

Not only the translation of wolves into categories and numbers leads to socioecological conflicts, but also the bureaucracy needed to maintain the monitoring processes on a population level. In one instance, a shepherd had to wait more than 7 months for the results of genetic samples that had been taken after some of his sheep were killed. His sheep were grazing on seacoast dykes that count as critical infrastructure, so the outcome could quickly result in a kill permit for the respective wolf. The shepherd was frustrated as he anticipated that the brisance of the topic prolonged the decision process. He also noted that the foregrounding of genetic evidence for damage statistics and the accompanying lengthy bureaucratic processes reinforced mistrust and aggravates conflicts between various (human) actors, reducing acceptance for wolf conservation policies.

(Supra-)state level conservation policies for wolves in Germany follow distinct ontopolitics by which wolves are understood as collectivities that need strict protection to reach the FCS. There is a need for numerical representation of various bodies, encounters, and situations for administrations to process modes of convivial coexistence as data. Convivial coexistence is a necessary component of wolf conservation. Only with a broad public acceptance, long-term wolf protection is possible. However, the quantification and measurability of conviviality produces new conflicts, i.a. because it compares the values and thereby hierarchizes different animals. As Collard and Gillespie (2015) remind us, doing critical animal geographies requires questioning hierarchization processes. Humans assign value to different animals either through conceptualizing them as collectivities or as individuals. Animals' values are rendered comparable in economic terms and in terms of their conservation urgency, but thereby also emotionally. The next section discusses the implications of wolf individualization. Here, it is important to keep in mind the different ontopolitics at work in making sense of wild animals, protected species and livestock.

### 2.2. The affective force of individual wolves

From an administrative perspective, wolf conservation in Germany follows biopolitical practices of maintaining a healthy population to reach FCS. Wolves are framed as collectivities (Srinivasan, 2017) for the sake of conservation but also individualized on a regular basis. Individualization happens randomly (when a wolf is identified after livestock kills) or deliberately (for the sake of genetic monitoring). Individualization can be beneficial or problematic for the individual wolf: it can make him a target of either protective or lethal measures.

For Germany, experts discuss spatial management approaches, such as wolf-free and wolf-protection zones, rather than general population management (Köck, 2018; Wolf, 2014). Official kill permits are rare and often accompanied by lengthy legal processes. A recent federal legislation has facilitated wolf killings in certain cases: a kill permit can now be issued, when a wolf is responsible for serious (=rnst) damage to livestock, earlier it had to be significant (=erheblich). However, as knowledge about wolf behaviour within German landscapes is still limited, there is disagreement over the question whether individual wolves or whole packs should be killed when responsible for damage.

Wolf habitats are naturecultures (Haraway, 2003), relational ontologies, in which humans and non-human animals coexist. Current biopolitics of wolf conservation in Germany involve that certain risks have to be taken into account for livestock, especially livestock that is considered more "defensive" such as cattle and horses (subsidies for fence material are often only provided for sheep and goat). As I will discuss later, calculating risks for possible livestock damages continues to fail considering the emotional value of domestic animals. Risk calculation is a form of technofix in conservation biopolitics, where ontopolitics of different species (collectivities vs. individuals) clash (Mol, 1999; Srinivasan, 2017; Whatmore, 2014). Horses for example are often individualized by their owners, but generalized in statistics. This is also where biopolitical practices aimed at the level of one particular species' population meet their limits. Animals can have an "affective force" (Lorimer, 2015). This not only holds true for cute-looking pets or charismatic animals such as elephants and tigers, but also for wild wolves. Speaking with Lorimer and Driessen (2013), they can be "monsters" to some, whose power "resides in their ability to shock; their abjection, or potential for horror" (ibd., 251). Fig. 1 shows part of a brochure by an association of pastoralists (WNON e.V.), who understand wolves as a threat to domesticated animals. From their perspective, it is not humans who have to learn how to live with wolves, but wolves have to learn how to live with humans.[2]

On the other hand, organizations like NABU view wolves as worthy of protection and in need of human support and offer so-called wolf adoptions (Fig. 2). These godparenthoods are not directed at individual wolves but help the NABU finance their public relations work on wolves. Consequently, there are different conceptualizations of wolfly "atmospheres" (Lorimer et al., 2019), attributing wolves distinct trophic and social relations.

The limits of a population perspective that ignores these affective biopolitics also become obvious in naming practices. When genetically identified, individualized wolves receive an official name consisting of letters and numbers, which is used, among others, in damage statistics. They often also receive a pet name in the process of becoming a 'problem wolf' and therefore a public figure. For example, the female wolf GW954f is also known as Gloria. She has preyed much livestock and the court decision in May 2021 not to kill her has spurred heated public debates (Die Zeit, 2021). Srinivasan (2017) has described how the ontological construction of turtles as collectivities (without caring for individual turtles) may create win-win-situations both for the survival of turtles as well as for the continuation of fishing practices, resulting in a greater acceptance of conservation efforts. The example of wolf conservation in Germany shows that conservation policies frame wolves as collectivities. However, as the naming practice shows, this regime crackles when technologies succeed in individualizing charismatic wolves, thereby challenging a population approach.

Similar cases have existed before: the wolf "Kurti" as well as "Roddy", a wolf in Lower Saxony who has killed a high number of livestock. Kurti was a male wolf and one of the first to wear a transmitter collar for research. He grew up in a military training area and soldiers supposedly fed him regularly. Consequently, he lost his shyness towards humans. In 2016, after he attacked a pet dog and repeatedly approached people in forests and fields, Lower Saxony's provincial government decided he was a threat and should be killed. It was considered ethically more appropriate to kill him than to transfer him to a game park.

Lower Saxony's provincial government also issued a kill permit for "Roddy" in 2019, after genetic analyses had shown that he had killed a large number of livestock, including horses and cattle. Due to protests by conservation organizations and night watches in the forest to prevent hunters from shooting the wolf, Roddy is still alive. Instead, a hunter mistakenly killed a young female wolf from Roddy's pack in April 2021, after which the kill permit for Roddy was revoked.

For wolves, individualization is problematic. Gloria, Kurti and Roddy have become the target of kill permits as they are categorised as so-called problem wolves. However, when it comes to general wolf

[2] https://wnon.de/pdf/gegen-die-woelfe.pdf.


**Fig. 1.** Part of a brochure by WNON. The caption reads *Wolfsfutter* (=food for wolves).

conservation, individualization can become a blessing and a curse. Gloria, Kurti and Roddy have become both individual who wolf proponents fight for as well as individuals who adversaries see worthy of killing for the sake of protecting livestock. However, individualization can also help conservation efforts: in the case mentioned, responsibility for the livestock kills lies not with the overall wolf population, but only with the individual wolf. Still, so-called problem wolves draw attention to the conflictual aspects of large carnivore conservation. In an interview with a regional newspaper, Lower Saxony's environment minister has emphasized that he views naming, and thereby personalizing individual wolves, as a threat to conservation efforts. He believes that it has spurred heated debates in the past years (Rundblick Niedersachsen, 2021).

The examples of individualization on the one hand and a population perspective on the other hand show that ontopolitics matter when it comes to conservation efforts. Individualization can evoke care by conservationists, but also targeted killings of the animal. While the singling out of a so-called problem wolf can take blame from other, ordinary wolves, the personalization of wolves continues to create catalysts for emotional and polarized conflicts between opponents and supporters of wolf conservation in Germany.

The next section turns to an interrelated, yet more material biopolitical practice. I discuss how fences, the most common livestock protection measure in Germany, infrastructure animals' lives in intended and unintended ways. Fences aim to facilitate a convivial coexistence by dividing spaces for livestock from spaces for wolves. However, impermeabiltiy can only be partial. Fences do not only attempt to divide spaces, but they also create new habitats in which convivial coexistence must be negotiated.

## 3. Protecting wolves, protecting livestock: infrastructuring animals

There is no enclosure in the form of nature reservoirs or national parks for wolf conservation in Germany. The animals have returned by their own effort, supported by the threefold conservation status (German, European and International Law). This means that packs can settle anywhere and there are no regional exceptions from the protected status. The first wolves, who had migrated from Poland, had mostly settled in unpeopled areas such as national parks or military training areas. Today, dens can be found in various places and wolves are regularly caught on camera roaming pastoral and urban spheres. The return of wolves has brought slow, but profound changes to pastoral landscapes. These changes are not only about the "shifting iconography of animals [.] in a rural setting" (Buller, 2004, 131) but are also very corporeal. I understand human responses in the form of fences and other protective measures to these changes and challenges as infrastructuring practices, "sometimes helping to stabilize particular orderings, sometimes opening up to contestation and change" (Blok et al., 2016, 3). They restructure multispecies relations in very material ways, thereby troubling human value systems for animals. I understand infrastructures as built (analogue or digital) environments that interact with their environment in intended and unintended ways. More-than-human infrastructures encompass such infrastructures that are meant to have a certain impact on flora or fauna. These could be wildlife crossings, fish ladders, or smart fences.

Infrastructuring practices for livestock protection are standardized on a provincial level, with few exceptions for specific landscapes such as dykes. A key infrastructuring practice are livestock protection fences. In contrast to camera traps and transmitter collars, their (disputed) material properties act on landscapes in more obvious ways. In Germany, fences are without any alternative. Densely populated landscapes leave little spaces for "wild" areas and pastoralists who do not build fences are considered negligent or even as training wolves to feed on livestock. To speak with Star and Griesemer (1989), they might first appear a boring thing to study. However, taking a closer look at how they infrastructure animals, fences highlight contradictions of different visions on convivial multispecies coexistence.

While infrastructure has been a focus of social science for some time (Star, 1999; Furlong, 2011), scholars have only recently begun to explore aspects of ecological infrastructures (Hetherington, 2018; Kimura, 2016; Morita, 2016; Richardson, 2016; Wakefield & Braun, 2018). With their introduction to a special issue on infrastructuring environments, Blok et al. (2016) have provided a genealogical overview of how infrastructure has become a conceptual lens not only for sociotechnical analyses, but also of the more-than-human world. The notion of ecological infrastructures invites researchers to "bring into view the activities, materialities, and concepts through which an environment is performed in always situated and contested ways" (Blok et al., 2016, 2). Some of the scholarship on ecological infrastructures has provided insightful capitalist critique of socio-environmental systems (s. Li, 2018 for infrastructural violence in the Indonesian Palm Oil Industry, s. Martin for the false promise of sustainability in landing salmon aquaculture) and focuses on the (deliberate) blind spots of global infrastructure expansions. Enns and Sneyd (2020) push the concept of infrastructural violence further and take their case study of the Chad-Cameron Pipeline project to discuss questions of more-than-human infrastructural justice. Infrastructural justice, they say, "requires addressing the social and environmental inequalities inscribed in new infrastructure networks while also taking seriously the infrastructural work done by nature" (Enns & Sneyd, 2020, 494). Concerning conservation, this understanding of infrastructural justice is helpful for dismantling emotional conflicts surrounding the effects that Livestock protection fences have on various animals. How do fences alter flora and fauna, who gets trapped, who gets protected? Barua has

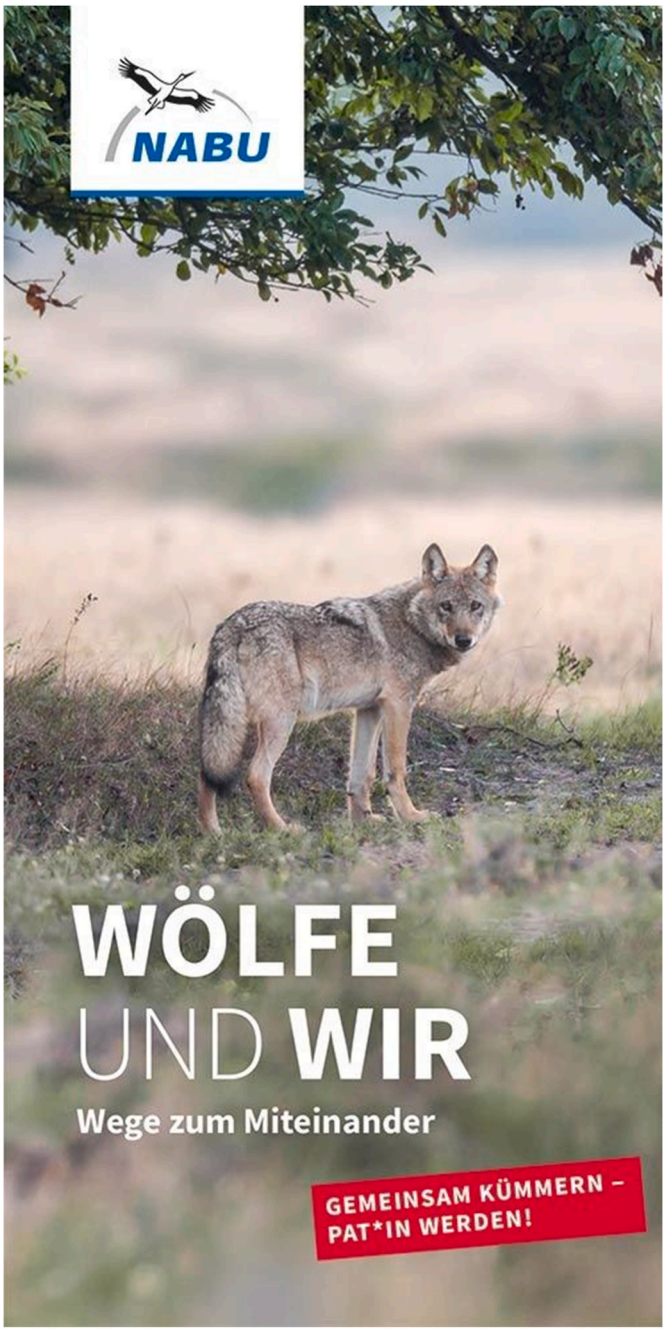


**Fig. 2.** The NABU advertises for wolf adoptions.

furthered the debate on "infrastructure and non-human life" enmeshments (Barua, 2021). He develops a wider ontology of infrastructure and invites for a "plural conversation around infrastructure" (Barua, 2021, 16). Moving away from an anthropocentric analytical framework, he centers different animals and how infrastructures alter their biogeographies and vice versa. His argument builds on three interrelated themes, which are infrastructures as modalities of circulation (for example macaques repurposing electric grids for their own mobilities in Indian cities or roads enabling or hindering non-human mobility), infrastructures as a medium of life/non-human habitus (for example living walls and rooftops on houses or animals (dis)appearing with certain industrial-chemical assemblages) and non-human life as infrastructure (for example elephants as laborers or beavers as ecological engineers).

I find these themes fruitful to think about built environments for conservation efforts in a less anthropocentric way. Infrastructures, as Martin et al. (2021) remind us, do not need to be permanent – they have their own unstable temporalities. They "are fragile, temporary and require repair and maintenance to ensure that they continue to work" (Martin et al., 2021, 49). Fences weather, have to be rebuilt and relocated. In their life cycles, fences become, to speak with Barua's terms, mediums of life. However, they do not only become mediums of life in a techno-material way, reconciliating or being repurposed, but are also embedded in conservation biopolitics reifying discursive categories (wild, game, problematic, domestic, important, unimportant …) of animals. They reify discursive categories through official guidelines that quantify fence height thresholds for problem wolves or by determining which electrocuted (small) animals count as collateral damage. In the following sections, I will take a detailed look at fences and other infrastructuring technologies in the context of wolf conservation. In doing so, I want to discuss the conflictual quantification of multispecies conviviality – both through "traditional" biopolitical technologies such as statistics and surveillance, but also through more-than-human infrastructuring practices where "corporeality and substrate meld or the habitat and habits of living beings get [sic!] become synonymous with infrastructural environments" (Barua, 2021, 1).

### 3.1. *Infrastructure as medium of life: fences as habitats*

In order to provide for a coexistence of pasture feeding and wolves, the German state has decided to provide technologies to livestock keepers that help prevent wolf attacks. Sheep and goat keepers can apply for subsidies in each province, as these animals are considered most vulnerable, which is also reflected in the damage statistics (DBBW, 2021b). The regulations for cattle, horses or other animals differ from province to province, sometimes from district to district, depending on the wolf presence. Building adequate fences is not only important for protection, they are also a prerequisite for receiving compensation in case of preyed livestock. However, what is considered an adequate fence, depends on the province, the landscape characteristics (e.g. dykes) as well as the type of animals. For example, the minimum requirement for wolf-proof fencing of goat, sheep, lamas and alpacas in Brandenburg are: a height of 90cms, a minimum voltage of 2500 V and a woven wire where the lowest wire is not higher than 20 cm from the ground. In addition, experts advise to add further visual deterrents such as barrier tapes or blinking lights to prevent wolf attacks. If a wolf kills any of the above mentioned animals protected by these fences, livestock keepers may receive financial compensation. However, a wolf (only) becomes a problem wolf if he overcomes fences that fulfill additional, so-called "reasonable" (zumutbar) measures. In Brandenburg, this means a fence height of 120 cm and a minimum voltage of 4000 V (2500 V if the *Aufwuchs* is wet or the soil very dry). In this case, a (genetically identified) wolf can be deemed a danger to livestock and "lethally extracted" (Land Brandenburg, 2018). These categorizations also have effects on wolf management. There are discussions about whether the whole pack of problem wolves should be killed as some wildlife biologists suggest that wolves can pass on their behaviour to others (Packard, 2003).

This understanding of a quantification of favourable conditions for convivial coexistence ignores those aspects of more-than-human infrastructuring practices where fences become habitats and animals have corporeal agency other than jumping. To a certain extent, fences are habitat to critters who live or move on it. More importantly, however, fences modulate habitat (and habit). For example, fences might keep a wolf's body outside of a pen, but his smell, his sound and his appearance remain perceptible to livestock. Fences aim to separate wild from domestic spaces, but only provide partial impermeability (Boonman-Berson et al. 2019; Flitner, 2019; Poerting et al., 2020). Animal's atmospheres (Lorimer et al., 2019) change, when humans infrastructure their environments. Lorimer et al. (2019) point out that "in many cases, these lethal, deterring, carceral, or otherwise governmental practices of atmospheric engineering aim to secure the productivity of a small

number of agricultural plant and animal species" (ibid., p. 38).

Instead of clear boundaries, fences create new contact zones (Haraway, 2008), in which they become habitats and modes of living are negotiated. Two of my interview partners reported how fences and even solid stables can lose their protective capacity. One is a shepherd in Lower Saxony. They keep about 800 sheep, with whom they are responsible for maintaining a heath landscape. In the summer, they roam the landscapes with mobile fences, while in winter, the sheep are kept in stables for much of the time. She recalls:

> "Wolves once went around one of our stables and upset the sheep so badly that they trampled each other dead within the stable. So what does a solid stable help when they still panic? So we built a buffer, we built a fence around the stable, built it even higher, but then a storm ripped it apart. So you're basically just building, building and controlling. And then the fox and the badger came and dug holes, so you have to fill in stones [laughs]. So you're just controlling and building".

In Brandenburg, a shepherd has made similar experiences with her 300 sheep who she guards with woven wire mobile fences overnight. For a few years, there have been no attacks by any of the three wolf packs roaming the area where she tends her sheep. In a recent attack, however, wolves outside the fence have upset the sheep so much that they broke through the fence from within to flee. As the shepherd's fences had matched the minimum protective measures mentioned above, she received compensation. But because the fences lacked the additional 30cms of reasonable fencing practices, the wolves' behaviour counts as non-problematic. Consequently, provincial officials have advised her to add an additional wire on 1.20 m not only to protect the sheep but also to facilitate the categorization of these wolves as problem wolves in case of another attack. The shepherd tends her sheep during the day and keeps them in a new pen almost every night. This means that she must remove and rebuilt her mobile fences every day, which makes the additional fencing almost impossible timewise. However, mobile fences over 95 cm become very heavy to carry and time-consuming to maintain. The provincial officials also suggested that she should seek help from Wikiwolves,[3] a loose alliance of volunteers in various provinces that has set itself the goal to support pastoralists with fence construction, mowing grass along the electric wires to increase voltage and night vigils to enable convivial coexistence. However, so far, there have been no volunteers in the sparsely populated rural area in Brandenburg.

Woven wire mobile fences as infrastructuring practices also regulate other wild animals. Roe deer and other hoofed game often follow distinct deer paths. Mobile fences can intersect these routes, involving dangers for hoofed game. However, game can also demolish fences in attempts to overcome them, thereby stripping livestock off their protection from wolves. Game, but also small wild animals such as hares or hedgehogs, who die because they get trapped or electrocuted in the fences, do not appear in damage statistics. They are taken as collateral damage by these fences. This also holds true for permanent fences built to protect livestock from wolf attacks. Permanent fences can also use woven wire, but most livestock protection fences for horses or cattle use straight wire. The lowest wire must not be higher than 20 cm from the ground, as research shows that wolves rather try to dig under the fence than jump over it. The type of the wire depends on the fenced animals: for horses, experts recommend special, more distensible wire because they have a different flight behaviour than, for example, cattle. Various agribusinesses now offer different types of Livestock protection fences, also helping with the complicated bureaucratic application procedures for subsidies. Critics of the current technological measures blame especially these stationary fences for creating sources of danger to wild animals and for parceling landscapes, hindering game mobilities and possibly altering ecologies profoundly.

[3] http://wikiwolves.org/.

Considering livestock protection fences as habitats and mediums of life, it is helpful to think with the concept of infrastructural justice suggested by Enns and Sneyd (2020). During my field stay with a cattle farmer in a region with wolf presence, the contradictions of building fences for conservation became obvious. The farmer has an organic Demeter certification, which means that he is obliged to have his cows calve outdoors. After a suspected kill of a calf by wolves the previous year, he wanted to build new or additional fences to protect his animals. He was advised to build permanent fences with five wires up to a height of 120 cm. His pastures lie in hilly landscapes, they are often small and crossed by creeks and forested areas. In order to build adequate livestock protection fences, the farmer would have to cut down bushes, trees and other flora. He decided against it as he had, among others, observed how the leaves of blackberry bushes had provided a rare food source for roe deer during the snowy winter. Building fences would therefore entail destroying existing infrastructures important for local biodiversity. From a more-than-human infrastructural justice point of view, livestock protection fences provide a certain amount of protection for pasture animals. However, they also create possible hazards for other animals, not only as a trap, but also because they may reduce access to food sources. Fences infrastructure animals, diverting mobilities and altering fauna.

### 3.2. *Quantifying animals' risk and value: infrastructures as biopolitics*

The safety of sheep gains more importance when fence regulations are enmeshed with human safety. For example, grazing sheep in Lower Saxony not only care for the dykes along rivers, but also maintain dykes along the seacoast for flood prevention. In some of these areas, wolves have settled or wander through. The dykes are popular among tourists and locals who stroll or bike along the coastline. On a regular basis, people forget to close gates or damage wires by climbing over them. As a result, adequate fencing according to official terms is challenging and the provincial government has decided that regular fencing (i.e. no livestock protection standards are needed) must count as sufficient protection to prevent wolf attacks in those areas. If a wolf overcomes these regular fences twice, a kill permit can be issued out of "public interest" (NLWKN, 2020). In addition, Lower Saxony has added another paragraph to its *Wolfsverordnung* (="wolf ordinance"), which says that kill permits for wolves can be issued if they overcome fences twice in areas where grazing is necessary for the permanent safeguarding of the diversity, uniqueness or beauty as well as the recreational value of existing protected landscapes according to the §1. 4 Nr. 1 Federal Nature Conservation Act (NLWKN, 2020). In other words, conservation biopolitics attempt to make the value of individual animals on the one hand and relational landscapes on the other hand comparable.

Fences also become habitats and change working animals' atmospheres that perform protective tasks with their corporeal abilities: livestock guardian dogs and donkeys as well as fainting goats. They are infrastructured in two ways: following Barua (2021), they can be understood as infrastructures themselves. To varying degrees, their "lively potentials" (Barua, 2021: 13) are harnessed to serve the protection of (economically and/or emotionally) valuable livestock. Livestock guardian dogs and donkeys work as bodyguards for other animals, defending herds when humans are not present. This somewhat "probiotic" (Lorimer, 2020) approach to livestock protection measures reaches its most extreme form in the case of fainting goats (also: myotonic goats or Tennessee fainting goats) as lively prey: in the case of a wolf attack, due to their hereditary condition, they faint and become easy prey, therefore diverting the wolf's attention away from the more valuable animals. However, the working animals' biogeographies are also affected by fences. Fences separate spaces materially, but also determine in which areas animals' protective or aggressive behaviour is deemed (ab)normal and where not. Fences as infrastructures alter ecological relations, but also become a crucible for the appropriateness of conservation biopolitics. Livestock guardian dogs who jump out of

fences become problem dogs. A shepherd who deployed donkeys to protect his herd of sheep along the seacoast dykes reported that the donkeys were doing a good job within the fenced area. However, when a tourist illicitly took her dog on a stroll along the dyke, one of the donkeys attacked the dog, partly flaying him. Since there are regular violations against the dog exclusion regulations on dykes, the shepherd decided to retire the donkeys to avoid further attacks. Although neither the shepherd nor the donkey were held responsible for the accident, it shows that multispecies infrastructuring practices are complex.

Infrastructuring animals for wolf conservation entails quantifying risk and value of different animals: wild, domestic, hybrid. Taking risks is quintessential for letting wolves return to German landscapes. Takings risks becomes a biopolitical practice. No matter how well-protected livestock is, there will always be a certain number of kills by wolves. From a more-than-human justice point of view, risk is first and foremost divided into wild and domestic animals (and to a much lesser degree humans). Wild animals are considered natural prey for wolves, so that risk is not a term used for them. It is believed that wolves primarily hunt older and sick animals, thereby supporting a healthy wildlife fauna, and maybe even adding to positive changes in flora due to an "ecology of fear" (Ripple & Beschta, 2004).

Concerning domestic animals, risk calculation is a technofix in conservation biopolitics where ontopolitics of different species clash. From a statistical point of view, sheep and goat have a higher risk of being killed by a wolf than cattle and even less so horses. Therefore, in many provinces, cattle and horse owners receive no financial support for adequate fencing. At the same time, there is a public pressure on livestock owners to provide adequate fencing. In several districts with a wolf presence, cattle or horse owners can apply for financial support when at least three animals of the respective species have been provably killed by a wolf within a certain radius (usually 30 km). For example, in 2019, 88.4% of preyed livestock were sheep and goat, 6.7% game kept in reserves, 4.4% cattle and 0.5% other animals. However, except for statistical reasons, horses are rarely generalized. They are individualized and rather considered pets than livestock. Here, biopolitical practices aimed at the level of one particular species' population meet their limits. Risk calculation makes sense from a supra-state level wolf conservation policy, but loses its ground in local multispecies assemblages.

Risk and value cannot be thought without each other. From an administrative perspective, compensation payments are considered voluntary *Billigkeitsleistungen* (=equity or fairness payments) by the state. Especially for horse owners, compensation payments, which are usually the slaughter price for the respective animal species, are not connected to the emotional value of their animals. Risking livestock or pet animals for the sake of wolf conservation makes little sense to pastoralists or animal owners who value their animals more than wild wolves. The quantification in the form of financial payments highlights the contradiction of risk calculation as biopolitical practice and affective force of different animals.

## 4. Conclusion: infrastructuring as biopolitics

Wolf conservation in Germany follows distinct biopolitical practices, which do not only govern wolves but also other animals' lives. These practices rest on the idea that wolves need strict protection as collectivities and that fences can reduce the risk for domestic animals. However, as my research shows, infrastructuring animals for wolf conservation is a conflictual biopolitical practice. Infrastructuring practices aimed at enabling convivial coexistence may provide basic protection to various types of animals, but also restructure multispecies relationships, generating new and challenging situations. Following Barua's (2021) proposal to think about how infrastructures alter animals' biogeographies, I suggest to think of fences as habitats, where the questions of who gets trapped, who counts as collateral damage and whose corporeal abilities determine who is to live or let die. Infrastructuring practices become conservation biopolitics by modulating habitat. Consequently, infrastructuring practices developed for convivial coexistence can also have the opposite effect when fences become death traps for livestock. In addition, there are different ontopolitics at work in every fence habitat, which means that the value of different (individual or collective) animals cannot easily be quantified.

The analyses in this paper have conceptual and empirical significance. The tension between a population perspective on the one hand and individualization and thereby personalization of wolves on the other hand shows that ontopolitics matter for conservation. Ontopolitics matter, because conservation often happens in multispecies landscapes, where (political) restructurings provokes socioecological conflicts. This observation also supports recent work in animal geography that calls for centring individual animals' atmospheres. Conservation policies do not only interfere on a population level, but also discipline individual animals' bodies. It is important to understand how technologies used for conservation interfere with animals' bodies both on an individual and on a population level. As the cases of the infamous German wolves Gloria, Roddy and Kurti suggest, individual wolves' atmospheres are different and so are their relationships with domestic animals. In addition, wolves' affective force evokes diverse emotional reactions from humans, complicating conservation efforts.

The close examination of fences as an infrastructuring practice shows that a multiplicity of things govern animal bodies. Fence heights, voltage, but also damage statistics and categorizations of normal and problem wolves discipline animals and determine who is to live or let die. It is the interplay of these processes that makes infrastructuring animals a biopolitical practice.

The quantification of measures aimed at providing convivial coexistence provides policymakers with a practicable solution for conservation administration. However, the resulting conflictual infrastructuring practices seem to reflect back on the very species the Habitats Directive wants to see protected. By violation of human-made thresholds, wolves can turn themselves into problem wolves, making themselves abject by law. The quantification of conservation and the complicated relationship between framing wolves as individuals or collectivities creates a thin line for wolves between being perceived as ecological engineers or abject live. From an infrastructural justice point of view, the German case shows that fences can be an interim solution but will continue to give rise to polarized conflicts concerning adequate livestock protection measures.

It might be fruitful to think how wolf conservation could look like without the framework of FCS as stated in the Habitats Directive. As a first step, and considering the unsuitable reference frame of measuring the FCS by nation-states, it seems important to foster and foreground a Pan-European monitoring process. It might also be fruitful to think if there can be conservation without quantification: in how far could convivial coexistence be equally important for conservation as compared to a certain number of protected species. Damage statistics could be more elaborate and there could be more in-depth reporting and management on a regional level that considers the specifics of different modes of pasture feeding.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## References


Adams, W. M. (2018). Conservation by algorithm. *Oryx, 52*(1), 1–2.

Asdal, K., Druglitrø, T., & Hinchliffe, S. (2016). *Humans, animals and biopolitics*. New York, NY: The More-Than-Human Condition (Roudlege).

Barua, M. (2021). Infrastructure and non-human life: A wider ontology. In *Progress in human geography*. https://doi.org/10.1177/0309132521991220

Biermann, C., & Anderson, R. (2017). Conservation, biopolitics, and the governance of life and death. *Geography Compass, 11*(10), Article e12329.

Biermann, C., & Mansfield, B. (2014). Biodiversity, purity, and death: Conservation biology as biopolitics. *Environment and Planning D: Society and Space, 32*(2), 257–273.

Blok, A., Nakazora, M., & Winthereik, B. R. (2016). Infrastructuring environments. *Science As Culture, 25*(1), 1–22 (D).

Boonman-Berson, S., Driessen, C., & Turnhout, E. (2019). Managing wild minds: From control by numbers to a multinatural approach in wild boar management in the Veluwe, The Netherlands. *Transactions of the Institute of British Geographers, 44*(1), 2–15.

Braun, B. (2007). Biopolitics and the molecularization of life. *Cultural Geographies, 14*(1), 6–28.

Braverman, I. (2014). Conservation without nature: The trouble with in situ versus Ex situ conservation. *Geoforum, 51*, 47–57.

Buller, H. (2004). Where the wild things are: The evolving iconography of rural fauna. *Journal of Rural Studies, 20*(2), 131–141.

Buller, H. (2008). Safe from the wolf: Biosecurity, biodiversity, and competing philosophies of nature. *Environment and Planning, 40*(7), 1583–1597.

Caniglia, R., Fabbri, E., Greco, C., Galaverni, M., & Randi, E. (2010). Forensic DNA against wildlife poaching: Identification of a serial wolf killing in Italy. *Forensic Science International: Genetics, 4*(5), 334–338.

Collard, R., & Gillespie, K. (2015). Doing critical animal geographies. Future Directions. In K. Gillespie, & R. C. Collard (Eds.), *Critical animal geographies: Politics, intersections and hierarchies in a multispecies world* (pp. 203–212). Routledge.

Council Directive 92/43/EEC. (1992). On the conservation of natural habitats and of wild fauna and flora. *OJ L, 206*, 22.07.

DBBW. (2021a). *DBBW - Dokumentations- und Beratungsstelle des Bundes zum Thema Wolf - DBBW-E (dbb-wolf.de)*.

DBBW. (2021b). National damage statistics. https://www.dbb-wolf.de/wolf-management/herd-protection/nationwide-damage-statistics.

Dillon, M., & Lobo-Guerrero, L. (2009). The biopolitical imaginary of species-being. *Theory, Culture & Society, 26*(1), 1–23.

Dufresnes, C., Remollino, N., Stoffel, C., Manz, R., Weber, J.-M., & Fumagalli, L. (2019). Two decades of non-invasive genetic monitoring of the grey wolves recolonizing the Alps support very limited dog introgression. In *Scientific reports*.

Enns, C., & Sneyd, A. (2020). More-than-human infrastructural violence and infrastructural justice: A case study of the Chad–Cameroon Pipeline project. *Annals of the Association of American Geographers*, 1–17.

Epstein, Y. (2016). Favourable conservation status for species: Examining the habitats directive's key concept through a case study of the Swedish wolf. *Journal of Environmental Law, 28*(2), 221–244.

von Essen, E., & Allen, M. P. (2015). Wild-but-not-too-wild animals: Challenging goldilocks standards in rewilding. *Species, 19*(1), 4.

von Essen, E., Hansen, H. P., Peterson, M. N., & Peterson, T. R. (2018). Discourses on illegal hunting in Sweden: The meaning of silence and resistance. *Environmental Sociology, 4*(3), 370–380.

Flitner, M. (2019). In F. Gesing, M. Knecht, & M. Flitner (Eds.), *Der Kiwi und das Possum: Räume schaffen für Leben und Tod* (pp. 387–414). *NaturenKulturen.* transcript-Verlag.

Foucault, M. (2003). *Society must Be defended: Lectures at the Collège de France, 1975–76*, 2003. New York: Picador.

Foucault, Michel. (2007). *Security, territory, population: Lectures at the Collège de France, 1977–78*. New York: Palgrave Macmillan.

Foucault, Michel. (2010). *The birth of biopolitics: Lectures at the College de France, 1978—1979*. New York: Picador.

Fredriksen, A. (2016). Of wildcats and wild cats: Troubling species-based conservation in the Anthropocene. *Environment and Planning D: Society and Space, 34*(4), 689–705.

Furlong, K. (2011). Small technologies, big change: Rethinking infrastructure through STS and geography. *Progress in Human Geography, 35*(4), 460–482.

Haraway, D. J. (2003). *The companion species manifesto: Dogs, people, and significant otherness* (Vol. 1, pp. 3–17). Chicago: Prickly Paradigm Press.

Haraway, D. (2008). *When species meet*. Minneapolis: University of Minnesota Press.

Hennessy, E. (2013). Producing 'prehistoric' life: Conservation breeding and the remaking of wildlife genealogies. *Geoforum, 49*, 71–80.

Hetherington, K. (Ed.). (2018). *Infrastructure, environment, and life in the Anthropocene*. Duke University Press.

Hodgetts, T. (2016). Wildlife conservation, multiple biopolitics and animal subjectification: Three mammals' tales. *Geoforum, 79*, 17–25.

Kimura, S. (2016). When a seawall is visible: Infrastructure and obstruction in post-tsunami reconstruction in Japan. *Science as Culture, 25*(1), 23–43.

Köck, W. (2018). Der Schutz des Wolfes und die Möglichkeiten der Entnahme in Deutschland. *NuR, 40*, 812–818.

Land Brandenburg. (2018). *Brandenburgische Wolfsverordnung. Verordnung über die Zulassung von Ausnahmen von den Schutzvorschriften für den Wolf*. https://bravors.brandenburg.de/verordnungen/bbgwolfv. (Accessed 18 June 2021).

Li, T. M. (2018). After the land grab: Infrastructural violence and the "Mafia System" in Indonesia's oil palm plantation zones. *Geoforum, 96*, 328–337.

Linnell, J. D., & Boitani, L. (2011). Building biological realism into wolf management policy: The development of the population approach in Europe. *Hystrix - the Italian Journal of Mammalogy, 23*(1), 80–91.

Loo, T. (2011). *States of nature: Conserving Canada's wildlife in the twentieth century*. ubc Press.

Lorimer, J. (2007). Nonhuman charisma, 5. In *Environment and planning D: Society and space* (Vol. 25, pp. 911–932).

Lorimer, J. (2015). *Wildlife in the anthropocene: Conservation after nature*. U of Minnesota Press.

Lorimer, J. (2020). *The probiotic planet: Using life to manage life* (Vol. 59). Minneapolis: University of Minnesota Press.

Lorimer, J., & Driessen, C. (2013). Bovine biopolitics and the promise of monsters in the rewilding of Heck cattle. *Geoforum, 48*, 249–259.

Lorimer, J., Hodgetts, T., & Barua, M. (2019). Animals' atmospheres. *Progress in Human Geography, 43*(1), 26–45.

Martin, S. J., Mather, C., Knott, C., & Bavington, D. (2021). 'Landing'salmon aquaculture: Ecologies, infrastructures and the promise of sustainability. *Geoforum, 123*, 47–55.

Mitchell, A. (2018). *Tracing wolves : Materiality, effect and difference (Doktorarbeit)*. Stockholm: Institut für Sozialanthropologie, Universität Stockholm.

Mol, A. (1999). Ontological politics. A word and some questions. *Sociological Review, 47*(1_suppl), 74–89.

Monsarrat, S., & Graham, K. (2018). Charismatic species of the past: Biases in reporting of large mammals in historical written sources. *Biological Conservation, 223*, 68–75.

Morita, A. (2016). Infrastructuring amphibious space: The interplay of aquatic and terrestrial infrastructures in the Chao Phraya delta in Thailand. *Science As Culture, 25*(1), 117–140.

NABU. (2021). Wölfe in Deutschland. Die wichtigsten Fakten in der Übersicht. https://www.nabu.de/tiere-und-pflanzen/saeugetiere/wolf/deutschland/index.html.

Niedersachsen, R. (2021). Umweltminister lies: Die Wolfs-Untergrenze ist längst überschritten. https://www.rundblick-niedersachsen.de/umweltminister-lies-die-wolfs-untergrenze-ist-laengst-ueberschritten/. (Accessed 1 September 2022).

NLWKN. (2020). Niedersächsische Wolfsverordnung. https://www.voris.niedersachsen.de/jportal/?quelle=jlink&query=WolfsV+ND&psml=bsvorisprod.psml&max=true&aiz=true#jlr-WolfsVNDrahmen. (Accessed 18 June 2021).

Packard, J. (2003). Wolf behavior: Reproductive, social, and intelligent. In D. Mech, & L. Boitani (Eds.), *Wolves: Behavior, ecology, and conservation* (pp. 35–65). Chicago: Chicago University Press.

Poerting, J., & Schlottmann, A. (2020). Das charisma der Petfluencer: Zur Medialisierung konsumtiver Mensch-tier-Beziehungen am Beispiel instagram. *Berichte. Geographie und Landeskunde, 93*(1–2), 145–170.

Poerting, J., Verne, J., & Krieg, L. (2020). Gefährliche Begegnungen. Posthumanistische Ansätze in der technologischen Neuaushandlung des Zusammenlebens von Mensch und Wildtier, 3. In *Geographische Zeitschrift* (Vol. 108, pp. 153–175).

Pooley, S., Barua, M., Beinart, W., Dickman, A., Holmes, G., Lorimer, J., Loverdige, A., Macdonald, D., Marvin, G., Redpath, S., Sillero-Zubiri, C., Zimmermann, A., & Milner-Gulland, E. (2017). An interdisciplinary review of current and future approaches to improving human–predator relations. *Conservation Biology, 31*(3), 513–523.

Richardson, T. (2016). Objecting (to) infrastructure: Ecopolitics at the Ukrainian ends of the Danube. *Science As Culture, 25*(1), 69–95.

Ripple, W. J., & Beschta, R. L. (2004). Wolves and the ecology of fear: Can predation risk structure ecosystems? *BioScience, 54*(8), 755–766.

Rutherford, S. (2013). The biopolitical animal in Canadian and environmental studies. *Journal of Canadian Studies/Revue d'études canadiennes, 47*(3), 123–144.

Sandström, C., Johansson, M., & Sjölander-Lindqvist, A. (2015). The management of large carnivores in Sweden—challenges and opportunities. *Wildlife Biology, 21*(3), 120–122.

Schröder, V., & Steiner, C. (2020). Pragmatist animal geographies: Human-wolf transactions in the Swiss Calanda region. *Geographische Zeitschrift, 108*(3), 197–222.

Shukin, N. (2009). *Animal capital: Rendering life in biopolitical times*. University of Minnesota Press.

Srinivasan, K. (2014). Caring for the collective: Biopower and agential subjectification in wildlife conservation. *Environment and Planning D: Society and Space, 32*(3), 501–517.

Srinivasan, K. (2017). Conservation biopolitics and the sustainability episteme. *Environment and Planning, 49*(7), 1458–1476.

Star, S. L. (1999). The Ethnography of infrastructure. *American Behavioral Scientist, 43*(3), 377–391.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology,translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science, 19*(3), 387–420.

Steeck, S. (2010). Wer hat Angst vor dem finnischen wolf? Die artenschutzrechtliche Ausnahmegenehmigung bei Arten im ungünstigen Erhaltungszustand. *Natur und Recht, 32*(1), 4–9.

Taylor, C. (2013). Foucault and critical animal studies: Genealogies of agricultural power. *Philosophy Compass, 8*(6), 539–551.

Trouwborst, A. (2014). *The EU habitats directive and wolf conservation and management on the Iberian Peninsula: A legal perspective*.

Trouwborst, A., Boitani, L., & Linnell, J. D. (2017). Interpreting 'favourable conservation status' for large carnivores in Europe: How many are needed and how many are wanted? *Biodiversity & Conservation, 26*(1), 37–61.

Wadiwel, J. (2009). The war against animals: Domination, law and sovereignty. *Griffith Law Review, 18*(2), 283–297.

Wakefield, S., & Braun, B. (2018). Oystertecture: Infrastructure, profanation and the sacred figure of the human. In K. Hetherington (Ed.), *Infrastructure, environment, and life in the anthropocene*. Durham: Duke University Press.

Whatmore, S. J. (2014). Political ecology in a more-than-human world. Rethinking 'natural' hazards. In K. Hastrup (Ed.), *Anthropology and nature* (pp. 79–95). New York: Routledge.

Wolf, R. (2014). Der Schutz des Wolfs im Lichte des europäischen Gemeinschaftsrechts. *Natur und Recht, 36*(7), 463–470.

Zeit, D. (2021). Urteil: Wölfin Gloria darf weiterleben. https://www.zeit.de/news/2021-05/06/urteil-woelfin-gloria-darf-weiterleben. (Accessed 2 June 2021).