Sustainable exploitation

The political ecology of the Livestock Revolution

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Cover picture: Hartmut Kiewert, »Tank«, 2010, oil on pe-tarp, 200 x 300 cm.
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PREFACE AND ACKNOWLEDGEMENTS

We live in urgent times. Fascists march again in Germany and elsewhere while people die on their escape towards fortress Europe. Every single day, 192 million land animals are killed for profit. One would think there is no time to sit at the desk writing a dissertation.

Nonetheless, the thesis was completed. Various scholarships made this possible. Most importantly, I am indebted to the Swiss National Science Foundation for its generous Doc.CH grant of excellence. Likewise, I thank the Haldimann Foundation and the University of Basel for generously financing a start-up scholarship, and the University of Basel and the Swiss University Conference (SUK) for their generous funding of the Doctoral Program "Law and Animals: Ethics at Crossroads" of the Law School of the University of Basel during which this dissertation was authored. Lastly, I recognize the Janggen-Pöhn Foundation and the Graduate School of Social Sciences of the University of Basel for their generous scholarships.

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This dissertation is dedicated to all those hearts burning for freedom and opposing oppression in these times full of fear and hate. For additional resources, check out *itsgoingdown.org* and *everydayfeminism.com*. Let's take care of each other and the world.

1 INTRODUCTION

"A revolution is taking place in global agriculture that has profound implications for our health, livelihoods, and environment."

(Delgado et al. 1999, 1).

1.1 Context

Animal agriculture emits more greenhouse gases than the global transport sector, it is the single largest driver of biodiversity loss and ocean acidification, and it contributes to the crossing of almost every other planetary boundary as well. It covers 45 percent of global land surface and turns 35 percent of the global cereal harvest into fodder. These environmental repercussions affect the Majority World first and foremost.[1] Almost one billion human beings compete in the demand for food against the animal industry's use of grain for feed. Essentially, the industrial exploitation and commodification of animals is linked to societal injustice: working conditions in factory farms and slaughterhouses are extremely precarious and risky, and the sector is inherently entangled with processes of colonization and the violent displacement of indigenous people. Last but not least, animal agriculture kills almost 70 billion land animals and more than a trillion aquatic animals every year for profit.

Nevertheless, international institutions anticipate global livestock production to virtually double by 2050. This "Livestock Revolution," referring to the agricultural Green Revolution of the 1960s, was coined in a joint discussion paper by the International Food Policy Research Institute, the International Livestock Research Institute, and the Food and Agriculture Organization of the United Nations in 1999 (Delgado et al. 1999). Back then, it projected an increase in the

1 The wording "Majority/Minority World" aims to replace Eurocentric, colonial, or otherwise unsatisfactory terminologies like "developing/developed," or "Global South/Global North." The author of the term, Alam, wanted to highlight that people living in so-called "developing countries" constitute the majority of humankind (Alam 2008). The dominant distinction developing/developed insinuates primitive/civilized, and implies one unidirectional pathway for all societies (Winant 2000, 174). "Developing" countries are defined by their lack of "development," which often translates into lack of economic development, progress, and money. Apparently, cultural achievements, social movements, or religious practices all do not contribute to such "development" (Tyner 2015). The split of the world into "Global South/Global North" suggests two equivalent categories (Dirlik 2007). Finally, the term "Western" builds on the "West" versus "East" clash of the Cold War (Sheppard and Nagar 2004), and simultaneously implies a center of the world of which some countries are "Western" (yet not so much "Eastern"). In contrast, the new concept Majority World "defines the community in terms of what it has, rather than what it lacks. In time, the majority world will reaffirm its place in a world where the earth will again belong to the people who walk on it," so Alam (2008, 87). The terminology Majority/Minority World has not yet fully entered academic discourse despite its origins in the 1990s. Interestingly, it is relatively prominent in (Critical Global) Disability Studies (Barnes and Mercer 2005; Grech 2016). The advantages of the Majority/Minority World distinction include its lack of a value-laden past; in addition, it accentuates a quantitatively disproportional relationship and thereby draws attention to asymmetric global power structures. Nevertheless, the Majority/Minority dichotomy still draws on the developing/developed or Global South/Global North legacy and simplifies an actually much more complex relationship.

consumption of animal foods through 2020, but the forecast has since been further developed through 2050. According to the discussion paper, the rising consumption is due to a growing demand for animal products in the Majority World triggered by population and income growth and urbanization. Basically, the Livestock Revolution and the concomitant "nutrition transition" towards higher intake of animal protein are deemed inexorable—and even beneficial—evolutions in the course of development and modernization. Furthermore, the sector is portrayed as crucial for food security and the environment, and "a rare opportunity for smallholder farmers to benefit from a rapidly growing market" (Delgado et al. 2000, 10).

Indeed, global livestock production has multiplied almost tenfold since 1961. This upsurge has only been possible via a rapid industrialization of the sector. Nonetheless, the geography of meat is highly unequal: while in 2011, the world mean per capita consumption of meat was 42 kilograms, the average U.S.-citizen consumed 118 kilograms, a Chinese citizen consumed 58 kilograms and an Indian citizen consumed four kilograms. People in the Minority World eat roughly three times as much animal protein as people in the Majority World.

The expansion of animal production is to be met through "sustainable intensification" in order to both increase productivity and decrease the sector's impact on the environment, its "ecological hoofprint" (Weis 2013a). Hence, the current thrust of sustainability policy, green growth or green capitalism, is also pursued in the animal industry, which concentrates on efficiency gains through technological enhancement and better management.

In light of finite resources, climate change, and the food crisis, one asks oneself: How can the Livestock Revolution be achieved? Why is it necessary in the first place, who has an interest in advancing it? And what about the consequences for animals, people, and the planet as a whole?

1.2 Research question, methods, and research field

This thesis dismantles the discourses and structures fueling the Livestock Revolution and interrogates its inevitability. Moreover, it examines the political ecology of sustainably intensifying animal production and its repercussions for farmed animals.

The two corresponding hypotheses are that the Livestock Revolution universalizes the Minority World's "meatified" system of production and consumption and that the *sustainable exploitation* of animals, while benefitting capital interests, exacerbates current social and ecological crises.

The applied method is a discourse analysis of reports on the Livestock Revolution from 1999 to 2016. Sociological discourse analysis studies the production, reproduction and transformation of social order on the basis of texts. Discourse analysis is therefore not solely about ideas but also about material reality. Analytically reconstructing the "storylines" (Hajer 1995; Keller 2013) of the Livestock Revolution, the dissertation scans who or what is responsible for the Revolution, by which means it shall be reached, and what reference values underlie the endeavor. As the Revolution builds on sustainable intensification, the study is embedded in a wider theoretical exploration of green capitalism and proposes a "mirror move" of naturalizing capitalism and capitalizing on nature.

This investigation is situated at the intersection of two research fields, critical animal studies and political ecology. Human-animal studies examine the societal relationship towards animals whereas its subfield, critical animal studies, particularly explores the political and economic conditions of this mostly oppressive relationship.[2] The myriad presence of animals in our daily lives and their immense cultural, religious, social, and economic importance imply that this relationship is not a biological but a highly *social* one, and, as such, historically and culturally contingent. The same assertion can be made for humanity's relationship with nature in general, and, more fundamentally, for the nature/culture divide per se.[3] Remarkably enough, a real boom in the scholarly exploration of the animal as a social subject—as part of society, and not as mere symbols or scientific objects—can be witnessed in the last decade, prompting an "animal turn" in science.[4]

Integrating ecology into political economy, political ecology, then, investigates the link between power structures on the one hand, and environmental destruction and access to resources on the other hand (Paulson, Gezon, and Watts 2005, 17). For instance, natural disasters are never solely "natural," but political: They disproportionally affect socially oppressed and economically disadvantaged groups (Peet, Robbins, and Watts 2011, 35). Similarly, the ecological crisis is always a multiple crisis composed by rising food prices, hunger, degradation of livelihoods,

2 Introductions to human-animal studies include DeMello 2012a; 2012b; Waldau 2013. For critical animal studies, refer to Nibert 2002; 2012a; 2013; Nocella et al. 2014; Nocella, White, and Cudworth 2015; Sanbonmatsu 2011a; Torres 2007. On tensions between the two areas, see Best 2009; Wilkie 2015. Distinctively sociological publications encompass Arluke 2002; Hobson-West 2007; Irvine 2008; Kruse 2002; Nibert 2003; Peggs 2012; 2013; Tovey 2003; York and Mancus 2013; and, for environmental sociology, compare Gunderson and Stuart 2014; York 2014.

3 This thesis approaches nature as socially produced and mediated, and autonomous at the same time. On the one hand, it departs from a constructivist position. There is no fixed and eternal essence of nature; nature is a social construct. On the other hand, the environmental crisis, the non-compliance of nature demonstrate that humans cannot define, govern, or control nature as they like (Brand and Wissen 2013, 690–91). Social relations are constituted by this materiality of nature. Haraway (2003) suggests to blur the distinction between the spheres of nature and culture and speaks of "naturecultures;" likewise, McCarthy proposes the term "socionature" (McCarthy 2005, 735).

4 For an explanation of the animal turn, compare Peters, Stucki, and Boscardin 2014; Ritvo 2007; Weil 2010; Wolfe 2011.

scarcity of energy, and so on (Brand and Wissen 2013, 688). Environmental problems are thus perceived as problems of social relations (Torres 2007, 78, 81). International institutions and the state are part of these socio-ecological relations, as well (Brand and Wissen 2013, 694).

On a disciplinary level, both critical animal studies and political ecology can be subsumed under environmental sociology, which typically combines social theory and empirical research on the environment (Dunlap, Michelson, and Stalker 2002, 15–16).

1.3 State of research

A discussion of the global increase in the consumption of animal products, in particular meat consumption, is still rare in sociology; even less widespread is a critique of the authority and unavoidability of this claim, or of the necessity to slaughter animals for profit in the first place. In consequence, the Livestock Revolution discourse remains uncontested, almost like a self-fulfilling prophecy. Likewise, the structures and interests behind the Revolution are unchallenged, and so is its modernization narrative. A small interdisciplinary group of authors, however, argue that the Livestock Revolution is a form of deliberate and directed change in global nutrition. Weis (2013a) and MacLachlan (2015) identify the "industrial grain-oilseed-livestock complex" backing the Revolution, Schneider (2014) complements the analysis with the concept of the "industrial meat regime." Rivera-Ferre (2009) tests the notion of the demand-driven character of the Livestock Revolution while Jarosz (2009) and Fritz (2014) scrutinize international trade. However, whereas these researchers underscore the power of the Livestock Revolution discourse, none of them performs a discourse analysis.

Sociological discourse analysis is indeed a quite novel method in the emerging field of human-animal studies.[5] In contrast, other reviews of the animal-industrial complex are relatively prominent and cover its social ramifications like traumatic work (Pachirat 2011), health issues (Gunderson 2012), hunger (Weis 2013b), violence to animals (Gunderson 2013), and, on a broader level, sexism (Adams 2000), racism (Kim 2015), and colonization (Belcourt 2015; Nibert 2013), including intersectional perspectives (Cudworth 2011; Deckha 2008). Thus far, approaches from the areas of political ecology and political economy are rare. Exceptions are Emel and Neo 2011, Winders and Nibert 2004, and, most importantly, Emel and Neo's recent anthology on the "political ecology of meat" (2015) which, incidentally, inspired the title of the present work. Still, though Stanescu (2011) discusses organic meat, and Clark (2012) the

5 Johnson (2012) and Stibbe (2001) contribute general investigations of the discourse on animals. The discourse of climate change and animal agriculture has been explored by Almiron and Zoppeddu (2015), Bristow (2011), Lee et al. (2015), and Whitley and Kalof (2014).

"greening" of the factory farm, the sustainable intensification of livestock production has hitherto not been addressed in the field.

A growing amount of studies investigate the animal industry's environmental impact (compare Hallström, Carlsson-Kanyama, and Börjesson 2015; Steinfeld et al. 2006), however, to the best of the author's knowledge, the effect on planetary boundaries has as of yet not been systematically assessed as in the present work.[6] What is more, these publications generally do not problematize the situation of farmed animals so crucial for critical animal studies.[7] Finally, none of the investigations cited here embed the animal-industrial complex in a wider critique of ecology, sustainable development, and green capitalism as forms of societal control.[8] This perspective on ecology structures the present discourse analysis and develops the notion of sustainable exploitation.

1.4 Relevance

The emergence of human-animal studies, the discussion of the morality of eating animals in general (Foer 2009) (a discussion that has a longer history, but which has only recently entered the mainstream), and the emerging debate on the ecology of consuming animal foods more specifically all demonstrate the subject's upsurge in scientific popularity as well as the sociopolitical necessity of this research.

The animal turn in academia represents a paradigm shift in the consideration of animals. This paradigm shift is accompanied by a growing concern for animal welfare worldwide (Benz-

6 One positive example is Pelletier and Tyedmers 2010. Nevertheless, there are signs of progress in that direction: in 2016, the Stockholm Resilience Center, the "birthplace" of the planetary boundaries model, has co-initiated the "EAT Foundation" for a sustainable global food system (EAT Forum 2016). Additionally, Kahiluoto et al. (2014) have calculated planetary *nutrient* boundaries. Gill (2013) bases her calculation of optimal feed efficiencies on the concept of planetary boundaries.

7 Why "farmed" animals? In the animal-industrial complex, animals are de-animalized through language. This de-animalization hides the inherent violence of animal production and renders it normal and acceptable (Hamilton and McCabe 2016, 346). Animal bodies are sold as "beef" or "pork," not as "dead cows" or "dead pigs." Farmed animals are considered natural capital, renewable resources that can be endlessly exploited. In point of fact, the term "livestock" concisely denotes how the animals are perceived: as literally living raw material, as "primary inputs." Current research in animal production speaks of "ruminant meat systems," "pork and poultry systems" (Wirsenius, Azar, and Berndes 2010, 637), or of "meat-producing species" (Fraser 2005, 25). Critical animal studies aim to dismantle this instrumental language—and also the dichotomy of humans versus animals—by consistently replacing it with terms deemed more accurate or just, for instance "animals" with "nonhuman animals," "livestock" with "farmed animals," or "meat" with "flesh" (Winders and Nibert 2004, 92). This thesis chooses a different strategy. It echoes the instrumental language in order to convey the dominant discourse, but also because it realistically mirrors the animals' reduction to "living stock." However, by periodically inserting unconventional terms like "farmed animals" or "flesh," the discourse is opened up and reveals its brutality.

8 The author's own previous work on these issues include Boscardin and Bossert 2015; Boscardin 2017a; 2017b, and, in German, Boscardin 2015; 2016. Narayanan (2016) delivers an exceptional account of animals in sustainable development, albeit with a focus on religion. Earnshaw delineates sustainability theories (and policies) that reduce nonhuman animals to renewable resources as "exploitation-based sustainability" (Earnshaw 1999, 115).

Schwarzburg and Ferrari 2016, 32; Cornish, Raubenheimer, and McGreevy 2016) and even substantial support for animal rights (Jamieson 2008, 182). However, there exists an opposite dynamic: more people continue to consume an ever-rising amount of animal protein. The quantity of exploited animals has reached a historic high: 69,468,244,528 individuals were killed for profit in 2013 (FAOSTAT 2016d). A comprehensive exploration of the Livestock Revolution under the new auspices of the animal turn is still missing, notwithstanding the growing controversy about the industrial exploitation of countless beings for food. What is more, such an in-depth account of the historic and future expansion of animal production relativizes and adds context to the growing movement for animal protection. Finally, this dissertation queries the legitimizations and necessity of brutally commoditizing animals overall.

If the livestock sector almost doubles its output by 2050, not only the violence perpetrated on animals but also the ecological hoofprint will escalate. Among others, the animal industry is one of the biggest causes of contemporary anthropogenic climate change. Tackling the sector would be "an integral part of any solution to climate change," according to the FAO (Gerber et al. 2013, 83). The breadth of the issue stands in stark contrast to the almost complete lack of attention—let alone action—international institutions dedicate to its mitigation (Twine 2010, 163). Neither the United Nations Conference on Sustainable Development in Rio 2012 (Kissling and Singer, June 15, 2012), the United Nations Framework Convention on Climate Change, nor its twenty-first session of the Conference of the Parties in Paris 2015 (COP21) charged the animal industry (Bailey, Froggatt, and Wellesley 2014, 7–9; Chellaney 2015). Contentiously, the industrial sector, transportation, and electricity generation have all received regulatory attention while the livestock industry has been entirely exempted (Ripple et al. 2013, 3; Rosin and Cooper 2015, 315).[9] In addition, the public generally does not link food to global warming, and places high social, cultural, and personal value on eating meat (Macdiarmid, Douglas, and Campbell 2016). In any case, the immense ecological and climate hoofprint stays—willingly or unwillingly—overlooked, which makes its examination even more pressing.

Above and beyond, the fossilist animal-industrial complex devours a gigantic amount of land, water, energy, fertilizer, and feed grains. At the same time, the number of people suffering from hunger and malnutrition has spiked in times of economic crisis, and the emergency is only an-

9 The FAO report *Livestock Long Shadow* confirms that "the environmental issues linked to livestock have not generally received an adequate institutional response—neither in developing nor in developed countries." (Steinfeld et al. 2006, 4). The response by non-governmental organizations, especially environmental ones, is, with few exceptions, equally and astonishingly marginal (Laestadius et al. 2014), which has been interpreted in the documentary "Cowspiracy: The Sustainability Secret" (Andersen and Kuhn 2014). Possible reasons for the neglect by non-governmental organizations are the fear of being accused of paternalism, of contravening societal commitments to the livestock industry, or of interfering with personal choices—although individual behavior has been a long-time focus of environmental campaigns (cases in point are taking shorter showers, car sharing, or saving energy) (Laestadius et al. 2014).

ticipated to get worse. Nonetheless, the livestock sector continues to convert 920 million tons of cheap and healthy cereals per year into expensive animal commodities. The diversion of grains will augment with the spread of livestock industrialization and a concomitant decline of pastoralism. This sweeping structural change, on the other hand, threatens to drive out small-scale farmers which currently constitute the majority of the 1.3 billion people depending on livestock production worldwide. Finally, environmental racism and colonialism keep being produced and reproduced in the animal-industrial complex.

These outcomes are not singular events but connected in a larger, complex context of the neoliberal control and capitalization of nature. Likewise, the system of sustainable animal exploitation is not future-compliant, despite its green veneer. It undermines the very resources it depends on. For Sumberg and Thompson, the Livestock Revolution is "one of the most powerful ideas to emerge in the area of food, nutrition and agricultural development over the last decade." (Sumberg and Thompson 2013, 5). The time is now to think outside the box and challenge this idea. Ultimately, in depicting the destructive industrial meat regime, the thesis can *e contrario* foster innovative and unorthodox paths in the imagination of new, more sustainable ways of relating to the more-than-human world.

1.5 Self-reflection and positionality

> "There can, of course, be no apolitical scholarship."
> (Mohanty 1984, 334).

Mohanty's statement on the impossibility of a neutral or objective standpoint has not lost a bit of its gravity thirty years later. For certain, this conception of knowledge clashes with the positivist postulate of a clear separation between subject and object. The continuous interaction between researcher and research object (Anderson 2015; Russell 2015), however, demands a consideration of the interest and contingency of any investigation. The importance of attending to one's standpoint has particularly been accentuated in recent work on intersectionality (Bilge 2013, 418). Yet, in many writings on the global food system, human-animal relations, and political ecology, the reflection of one's positionality and privileges remains, at best, relegated to footnotes. This paragraph subverts this custom and ponders on the circumstances of writing as a white, financially rich, able-bodied cis-woman holding a Swiss passport—in sum, to write from a privileged Minority World perspective—about the transformation of (animal) agriculture, mainly in the Majority World, led by the industrial meat regime that originated in the Minority World.

"[A]ll privilege is ignorant at the core" (Rich 1986, 226, quoted in Sholock 2012, 705). Yet, a reflection of one's own privilege and, from a global perspective, privileged choices can reduce the risk of moral and intellectual arrogance (Sholock 2012, 711).[10] In this macro-level investigation it would be misinformed to denounce individuals for their consumption of animal products. It is much more instructive to scrutinize the structures in place which enable, encourage, and virtually enforce such a diet. Further, concentrating on an evolution that has its roots in the Minority World, in one's own backyard—Switzerland being a paradigmatic case of livestock industrialization—is a constructive way to deal with one's positionality.

Therefore, the point of this work is neither to romanticize non-Eurosettler food cultures, nor to paternalistically decide for billions of people in the Majority World which diet or which way of life they should adopt. In reality, vegetarianism, for instance, is much more widespread in the Majority than in the Minority World. Moreover, it is not the point to negate or morally judge cultural change. Rather, the point is to show how it is the *Livestock Revolution* that denies the cultural difference and complexity of various regions in the Majority World by, on the one hand, discursively putting their societal development on a meaty modernization latter, and, on the other hand, by the structural chokehold of the industrial meat regime which is fostered by international institutions, large corporations, as well as governments and exporting countries in the Minority World in need of new markets.

Similarly, this account should not convey the impression of the Majority World as a victim without agency. The forms of resistance are manifold; for agricultural social movements, refer for instance to La Via Campesina 2015 or Lundström 2011. However, the focus of this dissertation is evaluating the dominant Livestock Revolution from the perspective of the Minority World—from the belly of the beast—and not an investigation of counterhegemonic struggle.

One issue of writing such a thesis as a vegan,[11] instead of as a carnivore or vegetarian, is the awareness of the ubiquitous and relentless animal suffering in the livestock sector.[12] Such a marginal perspective engenders unconventional and engaged research questions and methods (compare Anderson 2015). Mohanty defines feminist scholarship as "not the mere production of

10 Sholock (2012) elaborates a "methodology of the privileged" for white feminists engaging in anti-racist and transnational feminist theory. She combines self-reflexivity, racial sedition, and epistemic uncertainty and productively draws on the self-doubt, emotional pain, and embarrassment engendered by one's own racist bias.

11 Twine defines veganism as "a systemic and intersectional mode of critical analysis and a useful lived philosophy counter to anthropocentrism, hierarchy, and violence" (Twine 2012, 19). A specific form of an exclusionary vegan lifestyle ignoring societal injustice has been rightly accused of contributing to racism and classism; nonetheless, to delineate veganism as a solely white middle-class phenomenon is eradicating its Black and Brown history and practice (in a Eurosettler context, see Harper 2010a and Taylor and Fisher 2016). To continue this conversation, Greenebaum (2016) intersectionally deconstructs the notion of "vegan privilege;" Francione and Charlton (2015) accessibly counter the most common objections against veganism.

12 Hribal (2010) and Cohen (2015) focus on animal agency and resistance.

knowledge about a certain subject. It is a directly political and discursive *practice* in that it is purposeful and ideological." She further calls it "a mode of intervention into particular hegemonic discourses," challenging "legitimate" and "'scientific' bodies of knowledge." (Mohanty 1984, 334 [original emphasis]). Similar to feminist scholarship, an intervention from a critical animal studies or animal liberationist perspective addresses the systemic commodification of nonhumans and challenges legitimate bodies of knowledge. The goal of this discursive practice is to expose and confront the universalizing narrative of the Livestock Revolution in the tradition of "counter-storytelling." The Revolutionary Anti-Authoritarians of Color define counter-storytelling as "[w]riting that aims to cast doubt on the validity of accepted premises or myths, especially ones held by the majority" (2002, 5). Above and beyond, the investigation of the nutrition transition's modernizing narrative endeavors "epistemological decolonization" (Quijano 2007, 177), a critique of the "universal rationality" of the Eurosettler civilization. Quijano maintains:

> "Nothing is less rational, finally, than the pretension that the specific cosmic vision of a particular ethnie should be taken as universal rationality, even if such an ethnie is called Western Europe because this is actually pretend to impose a provincialism as universalism." (Quijano 2007, 177).

In sum, this dissertation scrutinizes the hegemonic Livestock Revolution discourse by contrasting what *is* with what is *being left out*. It is a negative critique of the existing rather than an affirmation of alternative practices and thus might raise more questions than it answers. Notwithstanding, this counter-storytelling discloses the profound impact the intensifying animal-industrial complex has on animals, society, and the planet as a whole, an appraisal that can serve as an intellectual foundation for social/food justice, environmentalist, and animal liberation initiatives.

1.6 Organization of chapters

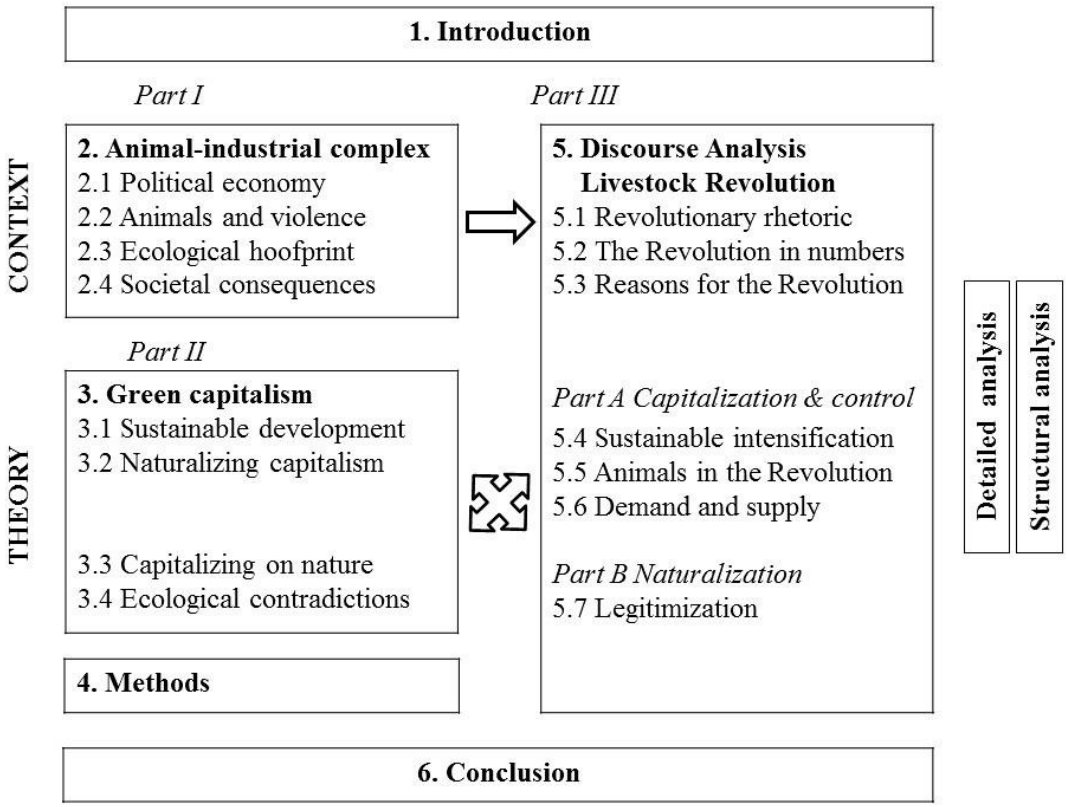


Figure 1: Chapter scheme.

As illustrated in the chapter scheme (figure 1), the thesis is ordered in three parts. After the introduction, in order to understand the scope and significance of the Livestock Revolution, the *first part* lays out its wider context: the animal-industrial complex. Its most vital characteristics are presented in chapter two. The first section (2.1) exemplifies the political economy of meat, milk, and eggs. Farmed animals occupy center stage in the second section (2.2). The industry's impact on planetary boundaries is described in section 2.3 and the societal aspects of animal production in section 2.4. This first part is an extensive literature and statistical review of the livestock industry: the Livestock Revolution has to be read against this background.

The *second part* provides the theoretical and methodological foundations of the discourse analysis that follows in the third part. It commences with the third chapter on green capitalism. The first section (3.1) critically examines sustainable development and its trajectory towards ecological modernization, and introduces the "mirror move" of naturalizing control and capitalism and controlling and capitalizing on nature. The second section (3.2) explores the first move of naturalization, whereas the third section (3.3) deals with the second move of control and capitalization. Lastly, the ecological contradictions of green capitalism and the current evasion of the environmental crisis are debated in section 3.4. This chapter has been elaborated in part as a litera-

ture review, but it has been equally developed in a cyclical process with the data examined in the third part of the thesis, therefore the arrows that point in both directions.

Chapter four elucidates the dissertation's methods. The basics of discourse analysis, following Hajer (1995) and Keller (2013), are outlined in section 4.1. Section 4.2 then expounds on the methods applied in the study, a review of the concrete research steps, including a self-reflection, the sample (policy documents on the Livestock Revolution and sustainable intensification), and the instruments of analysis and interpretation, divided in a detailed and a structural analysis.

Eventually, in the *third part*, chapter five presents and critically surveys the discourse of the Livestock Revolution. It starts with an exploration of the Revolution's rhetoric (5.1), its statistics (5.2), and alleged causes (5.3). The mirror move of green capitalism then structures the analysis in part A and part B. Part A, on capitalization and control, investigates the solution for simultaneously meeting the supposed upsurge in demand and balancing its environmental effects—sustainable intensification (5.4). Section 5.5 then sketches the place of farmed animals in the Livestock Revolution. The dichotomy of demand and supply is elucidated in 5.6. Thereupon, part B, on naturalization, encompasses an analysis of the Revolution's legitimization (5.7), covering modernization, food security, poverty alleviation, as well as environmental value. Finally, chapter six concludes the dissertation with a summary (6.1), the implications of its findings (6.2), an evaluation, and directions for future research (6.3).

PART I

2 THE ANIMAL-INDUSTRIAL COMPLEX

What is the animal-industrial complex? This rather knotty term is an adaptation of the term "military-industrial complex," coined by former U.S. President Eisenhower and aims to sum up the several dimensions and scales of the animal industry (Noske 1989). Sociologist Twine (2012, 23) defines the animal-industrial complex as a

> "partly opaque and multiple set of networks and relationships between the corporate (agricultural) sector, governments, and public and private science. With economic, cultural, social and affective dimensions it encompasses an extensive range of practices, technologies, images, identities and markets."

Hence, if we speak of the animal-industrial complex, *every step* in the production and consumption process is included, and, as Twine explains, the sector does not only encompass business, but also cultures, religions, emotions, politics, and societal questions in general.

The goal of this chapter is to provide an extensive overview over the most important aspects and consequences of the animal-industrial complex. The information from a broad literature review covers the political economy of the sector, the situation of farmed animals, the environmental repercussions according to the planetary boundaries model, and, finally, the societal aspects of animal production.

2.1 Political economy

This first section of the chapter concentrates on the political economy of the sector. After a brief history of the complex, essential facts and figures on production and consumption, and the output and input of industrial livestock systems are distinguished. Moreover, a short portrayal of the fishing industry is provided. From the perspective of a Minority World country in the early twenty-first century, the animal-industrial complex is embedded in financial interests and functions as a capitalist enterprise. Accordingly, the overall purpose of the animal-industrial complex is not the production of food or the satisfaction of basic human needs, but simply the maximization of profits. Mathias linguistically traces how throughout history livestock ownership has equaled wealth. She draws on the etymological kinship of the two words in many languages:

> "For instance *pecunia*, Latin for money, is based on *pecu* (livestock), as is *pecuaria*, the Spanish word for animal husbandry. The Sanskrit word *pashu* meaning livestock has the same root and is related to *paisa* which means money. The Persian Hindi word *mal* means both livestock and goods. *Vieh*, the German word for livestock goes back to the Saxon *fehu* that refers to livestock as well as money and is also the root of the English word *fee*. The word *cattle* is related to capital and the whole concept of paying interest for borrowed money was taken from livestock that was given on loan and reproduced in the meantime." (Mathias 2012, iv [original emphasis]).[13]

There is thus a certain historic consistency to the comprehension of farmed animals as *capital* and not as food. This monetary definition equally explains the reproduction of the violent, environmentally degrading, socially deteriorating, and inherently *inefficient* production of animal protein. In the complex, "efficiency" is not measured in terms of satisfying caloric needs but rather in terms of pleasing shareholders. They are the yardstick with which the complex is measured. In times when economic output supersedes all other variables, it can actually be enlightening to beard the lion in his den and examine the same hard numbers and statistics. Even more so, as almost no benchmarks for the animal-industrial complex's production, consumption, profitability and externalities are known to the general public, despite its ubiquity.

This pervasiveness is perceptible in the broad range of singular enterprises that the sector takes up, from feed producers, hatcheries, ranchers, pharmaceutical corporations, to slaughterhouses, governmental inspectors, packaging companies, to transnational retailers, marketing experts, stock exchanges,[14] nutritional scientists, state departments, restaurants, and fast food chains (Nibert 2011, 197). In fact, the state is a cornerstone of the animal industrial complex. It has agricultural and wildlife agencies, it sets the (legal) standards for rearing, confining, killing, and processing animal bodies, and it safeguards and subsidizes animal exploitation in farming and research (Sanbonmatsu 2011b, 26) (see paragraph "Subsidies and the power of lobbies" 2.1.4.3). By the same token, the animal rights movement is being disproportionately repressed all over the globe.[15]

2.1.1 A brief history of the complex[16]

13 More specifically, *capita*, the plural of the Latin word *caput* for head, designated "head of cattle" (Gunderson 2013, 261).

14 The commodity futures live cattle, hogs, feeder cattle, or milk are traded at stock exchanges (barchart 2016; EFT 2016).

15 Several countries have introduced sector-specific laws, such as the United States of America with the "Animal Enterprise Terrorism Act" from 2006. The Animal Enterprise Terrorism Act suggests the interpretation that the state favors protecting the interests of the animal industry over protecting the constitutional rights of its citizens (Torres 2007, 72). For a more in-depth scrutiny on the criminalization of animal rights activists in the United States, see Loadenthal 2016; Potter 2011.

16 Sociologist Nibert (2011) provides a rich and critical history of the animal-industrial complex, especially in the United States.

Whereas the livestock industry sells the consumption of animal protein and animal agriculture as completely natural and even innate to humankind, these are very peculiar cultural developments in human history. Gunderson observes that in the entire history of the human species, "hominids have likely survived for over 99.9 percent of their existence without a single domestic animal" (Gunderson 2013, 261).[17] A globalized form of meat production only started in the eighteenth and nineteenth century, when European countries such as Britain and Germany bought prodigious areas of land in South America, mainly in Argentina and Brazil. Thanks to refrigeration, the Europeans imported meat from the Americas and Australasia (Cudworth 2015, 100). Factory farming as we know it today was designed around 1900 and fully developed in the 1950s (Fraser 2005, 2).[18] Thenceforth, the livestock sector underwent massive changes in terms of input and output, economic and political importance, geographic distribution, organization, and technology (Gunderson 2013, 259).[19]

In the United States in particular,[20] the availability of meat was a "key ideological and cultural feature" post-World War I (Sanbonmatsu 2011b, 22).[21] After the Second World War, the expansion of the U.S. meat industry was triggered through the overproduction of grains and oilseeds (in particular corn, wheat, and soybeans), and subsequent state recommendations to alleviate this surplus via livestock production (Weis 2013b, 73; Winders and Nibert 2004, 76). Large-scale feed grain production was the basis of the Fordist, vertically organized mass-production of animals—with poultry production as its forerunner (Casey et al. 2015, 259). As geographer Jarosz writes:

> "Agro-industrial capitals fuelled the development and diffusion of the US model of grain production based upon capital intensive inputs, large-scale monocultures dependent upon synthetic fertilizers and pesticides and production destined for world markets and controlled by nationally based agribusinesses based in North America and Europe" (Jarosz 2009, 2069).

The export of U.S. grain surplus, especially wheat, as food aid or as cheap exports to the Majority World destroyed local agrarian economies and ruled out indigenous food staples like cas-

17 Refer as well to Smil (2011, 613) for the evolution of the human species and its impact on the biosphere.

18 A terrifying novel on the working conditions in the stockyards in Chicago and the life full of hardship of Eastern European immigrants is *The Jungle* by Upton Sinclair from 1906.

19 Jarosz describes how munitions factories were converted into nitrate fertilizer factories. Hence, military technology was directly remodeled as agricultural technology (Jarosz 2009, 2069). On the other hand, technology of the animal-industrial complex equally spread to other sectors: the moving lines of slaughterhouses were, among others, adapted for car production (Emel and Neo 2011, 69; Nibert 2011, 200; Sanbonmatsu 2011b, 22).

20 This thesis will consistently apply the terms "United States" or "United States of America" and not merely "America" to not dismiss the other regions of the continent (Martinez 2011; Orbe and Harris 2013, 57). The traditional designation "Turtle Island" by the Original Nations will be used if North America is addressed (Newcomb 2011).

21 The slogan of the 1928 Republican presidential campaign was "A chicken in every pot … [a]nd a car in every backyard" (Sanbonmatsu 2011b, 22).

sava, millet, beans, or yam (Jarosz 2009, 2069–70).[22] Structural adjustment programs redirected those countries' agricultural production to agro-exports like coffee, sugar, or cotton. To feed their people, these states became dependent on food aid and cheap food imports, namely heavily subsidized grain. Geographer Weis elucidates:

> "[t]his cheap food was celebrated by development planners and welcomed by recipient governments as a means to help foster urbanization and industrialization (a key part of a general development policy 'bias' to urban areas), and served to commoditize food security, reconfigure diets, and place new pressures on small farming livelihoods." (Weis 2013b, 72).

Between 1970 and 1987, the World Bank Group particularly fostered cattle operations with loans in Latin America (Nibert 2011, 203). Seemingly a contradiction in terms, agriculture was and is the main source of national income of the majority of the countries classified by the FAO as "Low Income Food Deficit Countries." 75 percent of the people who dispose of less than two USD a day are food producers (Collins and Chandrasekaran 2012, 4). On the other hand, in the Minority World, meat, formerly a sign of wealth and only dined on during special occasions, turned into an everyday staple for the masses (Jarosz 2009, 2074–75). Weis' concept of "meatification" encapsulates the radical shift from the marginal role animal foods occupied in the human diet throughout history to these products' current status as the cornerstone of most diets. As a result, while in the post-war diet in the Minority World, the consumption of meat became central, cheap, and available to the multitude, the "free market approach to food security" severely undermined food security and food sovereignty in the Majority World (Weis 2013b, 67, 72).[23] In sum, the "modern" post-World War II food regime was based on industrialization, dependence on oil, pesticides and fertilizers, and structural adjustment policies for the expansion of the animal-industrial complex enforced through the International Monetary Fund and the World Bank (Jarosz 2009, 2076).

In the 1990s, food scandals and health concerns such as the BSE crisis shook the industry.[24] In turn, new psychological and discursive means had to be applied to keep up the otherwise declining demand for animal products in the Minority World. A new market for niche and luxury products was created, satisfying specialized, "savvy" consumers with merchandise like "or-

22 In the 1970s, the United States tied food aid for Latin American countries to the production of feed-grain for export (Nibert 2011, 204).

23 Food security is defined as "the ability of people to secure enough food on a regular basis for healthy and productive lives" (Delgado et al., 37). Food sovereignty, on the other hand, is "the right of all peoples to produce and consume healthy and culturally appropriate food that has been produced through ecologically sound and sustainable methods. It enshrines people's right to define, and own, their own food and agriculture systems and demands that those who produce, distribute and consume food be at the heart of food systems and policies, rather than markets or corporations" (Collins and Chandrasekaran 2012, 23). For a comparison of the discourses of food security and food sovereignty see Jarosz 2014.

24 BSE stands for *bovine spongiform encephalopathy*, also called "mad cow disease."

ganic meat" (compare paragraph 5.5.2) or "Kobe beef." In this specialized sector, the industry tends towards horizontal organization, for example by outsourcing production to family farms (Sanbonmatsu 2011b, 23).

2.1.2 Facts and figures[25]

How did worldwide supply and demand evolve from 1961 until today? [26] In such an investigation, it is crucial to differentiate production and consumption statistics. Whereas the bulk of meat production is mirrored in food consumption, a particular share of milk or egg production is used for non-food purposes such as feed or industrial non-food use. Further, a significant amount of animal products is lost or wasted (compare footnote 107 on food loss and food waste). In addition, production can be used for export and will not translate into domestic consumption. Likewise, national consumption can be increased through import (FAO 2011b, 27–28). The split between production and consumption hence elucidates where the products stem from and where they are actually consumed. The animal-industrial complex is an unequal field for the power play of economic competition, and accordingly, the differentiation between production and consumption elucidates who produces and who consumes, which regions provide goods for other regions, and which countries—and corporations—dominate the market. Again, livestock products should primordially be comprehended as capital, and not as food.

2.1.2.1 Production

By weight, total world meat production has more than quadrupled from 71 million tons in 1961 to 317 million tons in 2014, as illustrated in figure 2 (FAOSTAT 2016a). This tremendous upsurge is mainly due to a rise in chicken meat production which has augmented tenfold. Beef production has doubled between 1960 and 2010 (Thornton 2010, 2854), and egg production roughly quadrupled (Weis 2013b, 67).

25 This paragraph builds on Boscardin 2017a, 2017b.
The following sections are on animal *agri*culture. For aquaculture compare chapter 2.1.5.
26 The statistics provided by the FAO on its database FAOSTAT start in 1961.

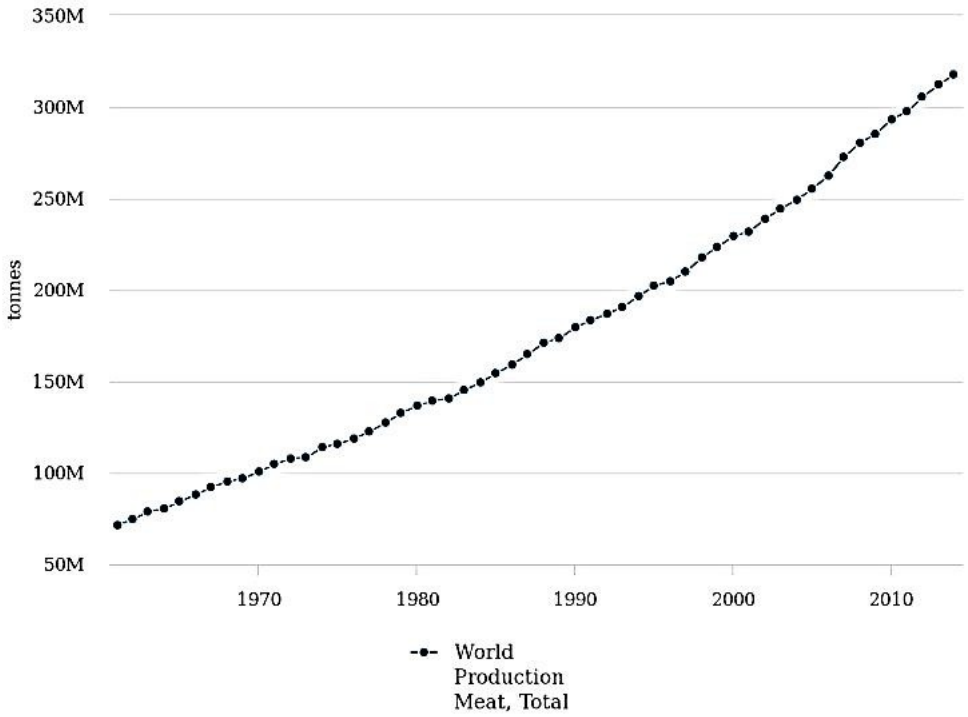
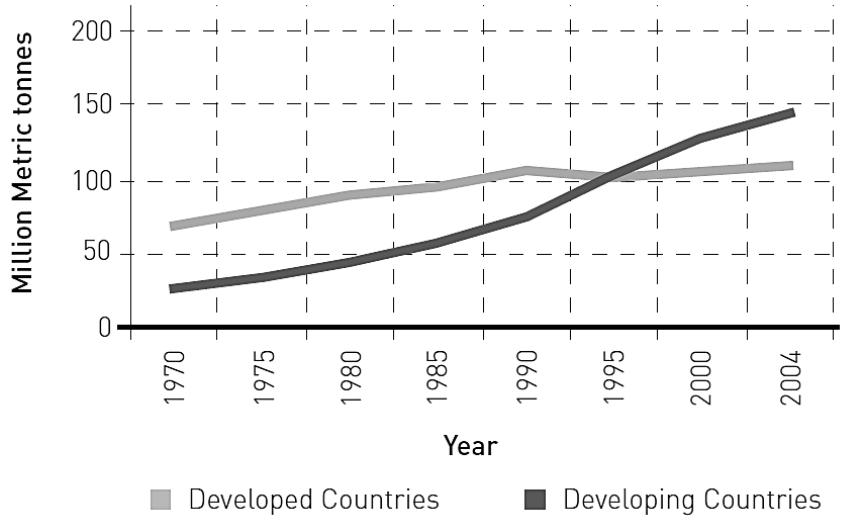


Figure 2: World meat production by weight from 1961 to 2014.
Data from FAOSTAT (2016a).

As outlined in chapter 2.1.1, the Minority World has pioneered the mass slaughter of animals for food production. Yet, in 1995, the Majority World surpassed the Minority World in the production of meat for the first time in history (compare figure 3). At this moment, the "centre of gravity" of meat production shifted from the Minority World to the Majority World, and this involved a shift in climatic regions, from temperate to tropical and sub-tropical, more humid spheres, too (Steinfeld 2004, 20; Steinfeld and Chilonda 2006, 3).[27]



27 In more detail, 50 percent of beef, 41 percent of milk, 72 percent of lamb, 59 percent of pig meat and 53 percent of poultry were produced in the Majority World in the year 2000 (Herrero et al. 2009, 112).

Figure 3: Meat production in so-called "developed" and "developing" countries, 1970-2004.
Reprinted from "Old players, new players," by Henning Steinfeld and Pius Chilonda, in Anni McLeod (ed), *Livestock report 2006* (p. 3), 2006, Rome: FAO. Copyright 2006 by FAO. Reprinted with permission.

A similar rearrangement is taking place for milk production. The Minority World still produces more milk, but the production is stagnating, while production in the Majority World is expressing a steady and significant growth, as demonstrated in figure 4.

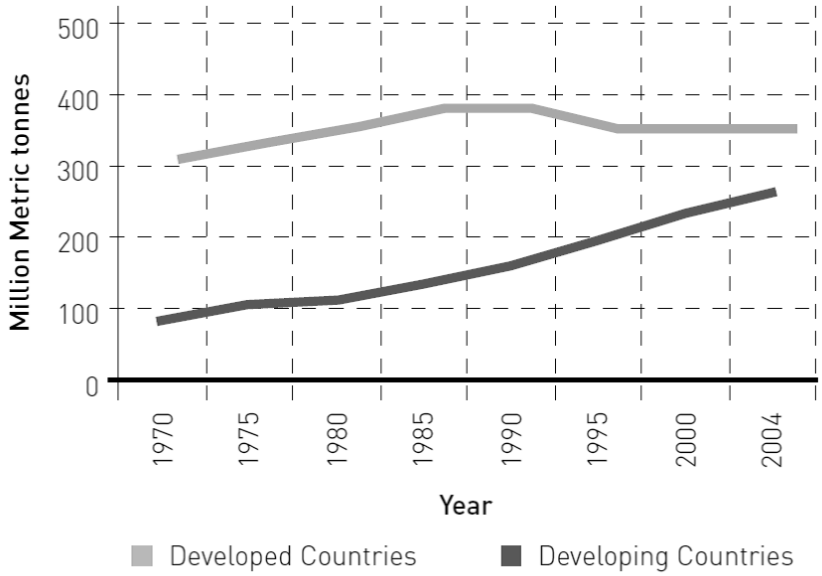


Figure 4: Milk production in so-called "developed" and "developing" countries, 1970-2004.
Reprinted from "Old players, new players," by Henning Steinfeld and Pius Chilonda, in Anni McLeod (ed), *Livestock report 2006* (p. 3), 2006, Rome: FAO. Copyright 2006 by FAO. Reprinted with permission.

Nonetheless, the stagnation in the Minority World and growing production in the Majority World should not conceal the former's dominance. In 2009, the United States, Australia, New Zealand, Argentina, Canada, and Western Europe together accounted for twelve percent of the world population, yet produced 34 percent of global meat production by volume, and issued 68 percent of world meat exports. On the other hand, the population of South and Southeast Asia and Africa represented almost half of the world, yet accounted for less than sixteen percent of total meat production (Weis 2013b, 68).

In addition, the simplistic division in Minority and Majority World hides regional and national differences. An astronomic rise in meat production and consumption is happening in East and Southeast Asia (Allievi, Vinnari, and Luukkanen 2015, 146). The region is responsible for half

of global pork production, almost all of which is provided by China (Gerber et al. 2013, 62). China is definitely an exceptional country in the unequal cartography of meat. It is home to roughly a fourth of the world's population and produces a third of the world's meat. Production in China increased 31-fold in the period between 1961 and 2009 (Weis 2013b, 68), and it delivered 57 percent of the total increase in meat production in the Majority World from 1980 until 2002 (Steinfeld et al. 2006, 16). China is equally home to the largest dairy farm in the world. In 2015, Chinese and Russian companies built a compound exploiting 100,000 dairy cows in Mudanjiang City in north-east China. The megaproject, worth 241 million USD, is three times bigger than the largest U.S. dairy farm, and fifty times bigger than the leading farm in the United Kingdom (Rotorua Daily Post 2015).[28]

India is another remarkable case of the animal-industrial complex' expansion (Gautam, Dalal, and Pathak 2010). Already in 1998, the country surpassed the United States as the world's biggest milk producer (Steinfeld and Chilonda 2006, 3). India accounted for 23 percent of the total growth in milk production in the Majority World from 1980 until 2002 (Steinfeld et al. 2006, 16). In addition, India recently outstripped Brazil as the biggest beef exporter in the world, despite the fact that Brazil's meat production rose by a factor of 11 between 1961 and 2009 (Weis 2013a, 86–87; 2013b, 68). In view of this evolution, India could soon surpass the United States as the world's biggest beef producer. The so-called "pink revolution" in India is particularly surprising as the country is known for religiously venerating cows. However, India's new slaughterhouses mainly process buffalos. India's great ruminant population and diets traditionally loaded with dairy products fostered the rise of the country's dairy industry. Meanwhile, the sector continues to undergo changes: whereas smallholders still provide the majority of the products, they are being trained in intensification, new feeding practices and animal health. Simultaneously, foreign investments and multinational corporations are taking over the market. Agribusiness particularly targets Indian chicken production (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 10, 40). Steinfeld and Chilonda interpret this development not as "organic", but as discontinuous, and explain:

> "as soon as urban markets develop, investors step in, often with no previous association with livestock production, and establish industrial type units and associated processing and marketing methods." (Steinfeld and Chilonda 2006, 9).[29]

2.1.2.2 Killed animals

28 The milk is destined for export to Russia, which was placed under economic sanctions by the European Union due to its role in the Ukraine conflict and in response banned European Union food products. The 100,000 hectares needed for feed production are supposedly mainly provided by Russia (Rotorua Daily Post 2015).

29 An in-depth examination of the global weight of transnational corporations follows in chapter 5.6.

All those dead numbers and dry country statistics hide the circumstance that the real producers of animal protein are not primarily geographic regions but live animals. In 2013, more than 69 billion nonhuman land animals were killed for food production. These sentient individuals were raised, exploited and ultimately slaughtered in order to sell their eggs, milk, particular organs, or mere flesh. The rather inconceivable number of 69 billion beings encompasses 61.2 billion chickens, 2.9 billion ducks, 1.4 billion pigs, 1.2 billion rabbits, one billion sheep and goats, 0.7 billion fowl, 0.6 billion turkeys, 0.3 billion cattle, 70 million rodents, 4.8 million horses, 2.6 million camels, and countless other individuals (FAOSTAT 2016d).[30]

It is instructive to compare the increase in animal killings over the last decades with the growth of the global human population. In 2013, the latter comprised 7.1 billion individuals (FAOSTAT 2016b). This corresponds to a "killed animals / live humans" ratio of almost 10:1. In 1961, the number of slaughtered farmed animals was eight billion, and the human population around three billion, resulting in a "killed animals / live humans" ratio of roughly 3:1. Whereas the human population more than doubled from 1961 to 2011, the total of slaughtered animals increased more than eightfold.[31] The assessment of the biomass of all terrestrial vertebrates in table 1 gives another idea of the literally extraordinary weight of the animal-industrial complex.

Table 1: Biomass of wild and domesticated animals, 1900 and 2000, estimated in million metric tons of carbon.

Year	Humans		Wild terrestrial mammals				Domesticated animals (including pets)				Total	
					Elephants				Cattle			
1900	13	**23%**	10	**17%**	3	5%	35	**60%**	23	40 %	58	100 %
2000	55	**30%**	5	**3%**	0.3	0.2 %	120	**67%**	80	44 %	180	100 %

Note. Adapted from "Harvesting the Biosphere: The Human Impact," by Vaclav Smil, 2011, *Population and Development Review* 37 (4), p. 619. Copyright 2011 by John Wiley and Sons. Adapted and reprinted with permission.

30 The 2013 figure is slightly higher than the total killings in 2012 (plus 1.98 percent), with a particular growth in killed pigs (plus 3.95 percent), chickens (plus 2.33 percent), and cattle (plus 1.33 percent). The exact numbers are 69,468,244,528 slaughtered farmed animals in 2013, and 68,115,243,382 in 2012 (FAOSTAT 2016d).

31 As for the different species, the chicken population increased more than fivefold, and the goat population more than threefold. The buffalo and pig population doubled, and the cattle population, somewhat surprisingly, only increased by a factor of 1.5 (MacLachlan 2015, 28).

Table 1 compares the biomass of humans, wild terrestrial, and domesticated animals in 1900 and 2000, estimated in million metric tons of carbon (Smil 2011, 619). Total biomass has tripled, and domesticated animals now represent 67 percent of all terrestrial vertebrates by weight. Human biomass has grown from 23 to 30 percent. Most strikingly, the biomass of wild terrestrial mammals has shrunk from 17 to mere three percent. Elephants, for example, once constituted five percent of total biomass. Nowadays, they have almost been wiped out from the globe. The current biomass of cattle is 267 times bigger than the one of elephants.

2.1.2.3 Consumption

The enormous increase in production and the meatification of diets after the Second World War have triggered a tremendous upsurge in per capita consumption of animal foods. While in 1961, the world average per capita consumption was 23 kilograms of meat and 5 kilograms of eggs, in 2011, five decades later, the average consumption was 42 kilograms and 10 kilograms respectively. Hence, both meat and egg consumption roughly doubled in five decades (Weis 2013b, 67). Nevertheless, these average figures again conceal the fact that the geography of meat is highly uneven. In the Majority World, the yearly mean consumption of meat is 16 kilograms per capita (FAO 2011b, 5). In the Minority World, per capita consumption of meat and milk is roughly three times higher (Steinfeld and Chilonda 2006, 3).

Country statistics provide a more differentiated statistical picture: In the United States, people consume on average 118 kilograms a year, in Italy, 87 kilograms, in South America 78 kilograms, in China, 58 kilograms—which is the half the U.S. consumption –, in Africa 19 kilograms, and in India 4 kilograms (FAOSTAT 2016c). The stark and sometimes diametric changes in consumption in the Majority and Minority World from 1970 to 2002 have been calculated by Steinfeld and Chilonda (2006) as illustrated in table 2.

Table 2: Meat and milk consumption in the Majority and Minority World, 1970-2002.

	Majority World					**Minority World**			
	1970	**1980**	**1990**	**2002**		**1970**	**1980**	**1990**	**2002**
Annual per caput meat consumption (kg)	11	14	19	29		65	75	82	80
Annual per caput milk consumption (kg)	19	23	27	31		122	99	92	93
Total meat consumption (million metric tons)	29	47	74	139		70	88	103	105
Total milk consumption (million metric	82	119	167	256		307	346	372	343

tons)									

Note. Adapted from "Old players, new players," by Henning Steinfeld and Pius Chilonda, in Anni McLeod (ed), *Livestock report 2006* (p. 3), 2006, Rome: FAO. Copyright 2006 by FAO. Adapted and reprinted with permission.

Whereas in 1970, annual per capita meat consumption was 11 kilograms in the Majority World, it was 65 kilograms in the Minority World, a difference of factor 5.9. For milk, the relationship in 1970 was 6.4: people in the Majority World consumed 19 kilograms of milk per capita, and 122 kilograms in the Minority World. In 2002, 32 years later, annual meat consumption per capita in the Majority World rose from 11 to 29 kilograms, and annual milk consumption per capita from 19 to 31 kilograms. This was translated into a surge of total meat and milk consumption of 29 to 139 million metric tons and of 82 to 256 million metric tons, respectively (Steinfeld and Chilonda 2006, 3).

Although the Minority World still accounts for the major part of global meat consumption, the trend is negative. Land has become scarce in the Minority World, feed and energy have become costlier. The business of beef in particular does not have good prospects. In point of fact, the situation is being reported as "dramatic." In the United States, meat consumption has dropped by almost ten percent between 2007 and 2012. The demand appears to be satiated. Further, consumers are concerned by repeated food scandals, health crisis, low meat quality, and animal welfare violations. The Minority World reaction to those stagnating sales figures is to (violently) take the bull by its horns. It invests in new markets in the Majority World and not only exports its meat consumption, but also meat production patterns (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 10–17, 46).[32]

Domestic consumption is chiefly augmenting in China, India, and Brazil. Brazil's yearly per capita meat consumption increased from 28 kg to 73 kilograms between 1961 and 2009; in China, it increased from four to 59 kilograms (Weis 2013a, 86–87; 2013b, 68). Chinese consumption patterns have changed dramatically in the last five decades; for millennia, people ate meat once a year. And despite the lactose-intolerance of the majority of Chinese people, consuming dairy produce is likewise gaining popularity (Rotorua Daily Post 2015). Still, the growth in consumption predominantly affects middle- and upper-class urban consumers (Schneider 2014, 617). At the same time, according to a report by Public Radio International in 2013, veganism is a growing trend in China. Today, 50 million people—four to five percent of the population—are vegetarians, which outnumbers the 20 to 30 million vegetarians living in the United States (Magistad 2013). The traditionally vegetarian country India equally faces a tremendous

32 Compare also Sanbonmatsu 2011b, 23; Twine 2012, 14.

increase in meat consumption, especially as chicken and fast food meals are popularized, particularly among the young (Farrell 2002; Steinfeld and Chilonda 2006, 9). Though religious and cultural norms demand a strictly vegetarian diet, the urban upper classes have begun to turn away from vegetarianism and follow the Minority World carnivorous trend, which is regarded as a status symbol (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 49).

2.1.3 Industrialization: Output

The tremendous rise of production and consumption figures discussed above was only feasible via a correspondingly drastic growth of industrialized production (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 12). Which are the characteristics of industrial systems, how does the corporate landscape look like in the animal-industrial complex, and what kind of output in terms of bodies and species do industrial livestock operations generate?

2.1.3.1 Concentrated Animal Feeding Operations

Nowadays, industrial livestock systems are prevalent not only in their countries of origin, Turtle Island and Europe, but also in parts of the Majority World: in East and South Asia, Oceania, Latin America, and the Near East (Nardone et al. 2010, 63–64; Steinfeld 2004, 22).

Industrialized production is to be distinguished from the other two main livestock production systems: grazing or pastoral systems, and mixed crops livestock systems (Nardone et al. 2010, 63–64). Pastoral systems are located in Africa, Asia, Australia, and in some parts of the Americas and Europe. They utilize three billion hectares of arid pasture and provide around 20 percent of global ruminant meat production (Herrero et al. 2009, 112). Nonetheless, the future of pastoral systems is unclear. According to FAO experts, they "will increasingly provide ecosystem goods and services that are traded" (Thornton 2010, 2861)—this transferal will be discussed in more depth in chapter 5.6.5. Integrated crop-livestock systems are mixed systems which are to be found in Central Africa, India, South and North America, and Central and Eastern Europe, covering 2.5 billion hectares of land. They account for 90 percent of global milk production, 40 percent of egg production, and 70 percent of ruminant meat production (Nardone et al. 2010, 63–64).[33] Yet, in the last decades, industrial systems grew exponentially and today account for 77 to 79 percent of world's pork, poultry meat and egg production (Herrero et al. 2013, 20889, cited in MacLachlan 2015, 32).[34] A more detailed (and conservative) account is offered by Nar-

33 See also Wright et al. 2012, 1010–11.

34 Between 1981/83 and 1991/93, industrial systems grew 4.3 percent, mixed farming systems grew 2.2 percent, and grazing systems 0.7 percent (Seré and Steinfeld 1996, quoted in Steinfeld 2004). This means that industrial systems grew twice as much as mixed systems and six times as much as grazing systems (Delgado et al. 1999, 17). The FAO-report *Livestock's Long Shadow: Environmental Issues and Options* maintains in 2006 that industrial systems provide 80 percent of total sector growth (Steinfeld et al. 2006, 278).

done et al., maintaining that 70 percent of poultry meat, 55 percent of pig meat, and 60 percent of eggs are produced in industrial systems (2010, 63–64).[35]

Industrial systems are completely transforming the sector. Basically, industrialization comprises intensification, corporate consolidation, regional concentration, and the exploitation of economies of scale[36] (Costales, Gerber, and Steinfeld 2006, 20). More specifically, intensification means intensified livestock and feed production, an amplified use of technological means and genetics, and, in sum, a shift from small-scale, backyard, or mixed-system production, to factory farms. The technical term for factory farms is *Concentrated Animal Feeding Operation* (CAFO). Animal geographers Emel and Neo define CAFOs as "the concentration of live animals (pigs, poultry or cattle), manure, and urine to small spaces where feed is brought in" (Emel and Neo 2011, 67). In the United States, a medium-sized CAFO consists of 500 livestock units, which means 50,000 chickens or 2,000 pigs (EPA 2017).[37] Other terms for factory farms are *Industrial Livestock Operation* (ILO) (Weis 2013a, 1) or "landless" system. The designation "landless" refers to the fact that in such systems, less than ten percent of the dry matter fed to farmed animals is produced on the farm (Thornton et al. 2009, 115). Hence, with CAFOs, meat production has been decoupled from feed production. Correspondingly, the location of a factory farm only depends on available feed concentrates, on water and land resources for waste disposal, and on production cost (Emel and Neo 2011, 74; FAO 2011b, 31; Sneeringer 2009, 126). Infrastructure and access to the market are other decisive factors. In Europe, for instance, the regions near the port of Rotterdam, the most important access-point to soybeans and soybean meal, are hubs of chicken and pig production (Idel and Reichert 2013, 144).[38] For sociologist Schneider, the separation of livestock from feed production corresponds to a *metabolic rift* (Schneider 2014, 615, 625).[39] Slingenbergh, Hendrickx, and Wint even deem the disconnection from the land between the CAFO, crop land, the processing industry, and the market "the most peculiar feature about animal production" (Slingenbergh, Hendrickx, and Wint 2002, 32).

35 Once more, China has an exceptional record: 90 percent of its chickens are raised in CAFOs (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 40).

36 Economies of scale are defined as "cost reductions realized through expanding the scale of operations" (Costales, Gerber, and Steinfeld 2006, 21). In other words, the production cost per piece of output decreases with increasing output, namely, with mass production.

37 In the animal-industrial complex, animals are counted in livestock units. The livestock unit coefficients are regionally different. The conversion factors are highest in Turtle Island where one cow corresponds to 1.0 livestock unit. In other OECD countries, they are 0.90 for cattle, 0.10 for sheep, 0.25 for pigs and 0.01 for poultry. In South Asia, conversely, the units are 0.50 for cattle, 0.10 for sheep, 0.20 for pigs and 0.01 for poultry (FAO 2011a, 37).

38 Those areas, namely the Netherlands, Denmark, northern France and northern Germany, have additionally benefitted from European Union agricultural investment assistance to set up the production sites (Idel and Reichert 2013, 144). Furthermore, the geographical separation of production and consumption, and thus terrestrial extension of the animal-industrial complex, are fueled by the low costs of transport (Steinfeld et al. 2006, 76).

39 The metabolic rift divorces productive from consumptive activities, and human cycles from natural cycles (Schneider 2014, 615, 625).

Besides, the regional concentration means that millions of live or dead animals are being transported all over the globe (Emel and Neo 2011, 69). Between 1961 and 2007, the global trade of meat has multiplied nine-fold, and the global trade of milk five-fold (Deutsch, Lannerstad, and Ran 2011, 2). Multilateral and regional trade agreements are gaining importance (Steinfeld 2004, 36).[40] The biggest soy importer remains China, importing 56 percent of the global soy volume (Emel and Neo 2015, 1; FAOSTAT 2014d; Schneider 2014, 624). The European Union with its low tariffs on oilseeds has a high level of soy imports, too, mostly from Latin America (Idel and Reichert 2013, 143). In contrast, Argentina is the biggest soy exporter, followed by Brazil (FAOSTAT 2014e). New Zealand is the biggest dairy exporting nation, followed by the European Union, with the major exporters being Germany, France, and the Netherlands (Deutsch, Lannerstad, and Ran 2011, 2).

2.1.3.2 Corporate consolidation

To compete in a sector with tight profit margins, the go-to strategies are increasing output while decreasing input, and the concentration of corporate power (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 12–13).[41] Corporate consolidation is ruling out smaller farms in favor of CAFOs, and whereas the factory farms are expanding in size, their total number has declined. In both Canada and Denmark, from 1980 to 2001, the number of chicken farms plunged 80 percent (Fraser 2005, 25). In the United States, from 1980 to 2005, 90 percent of pig raisers lost their job, with the national pig population remaining constant (Carvajal and Castle, May 05, 2009; Heinrich Böll Foundation and Friends of the Earth Europe 2014, 10). In addition, from 1970 to 2014, the number of U.S. slaughterhouses diminished from almost 10,000 to less than 3,000 (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 14). Similarly, four corporations controlled 60 percent of the U.S. American poultry market in 2005 (World Bank 2005, xi). The development shakes the Majority World, as well (Costales, Gerber, and Steinfeld 2006, 21). Already in 1996, ten vertically integrated companies provided 80 percent of poultry production in Thailand. These companies contract medium and large-scale producers to raise day-old chicks from their hatcheries and with their feed (Khan and Bidabadi 2004, 117). In the Philippines, 80 percent of the broiler market is controlled by six corporations that are united in

40 Trade agreements on animal products concern food safety, animal welfare, environmental protection, or corporate legal rights. Food safety issues include the use of food and feed additives, or of genetically modified organisms. The Agreement on sanitary and phytosanitary standards (SPS) of the World Trade Organization, for instance, allows countries to develop their own food safety standards, provided they offer scientific backing. This standard is interpreted by some as protectionism by the Minority World (Steinfeld 2004, 36). Another economic battle is being fought between the United States and the European Union. While the former pressure the latter to lift its ban on *ractopamine*, a feed additive to enlarge the development of lean meat in pigs and cows, the United States, fearing BSE contamination, restrict beef imports from the European Union because of its allowance of feed additives sourced from ruminants (in other words, the European Union allows feeding live cows with dead cows, in contrast to the United States) (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 18–19).

41 This development is hitting not only animal farming, but agriculture in general (Holt Giménez and Shattuck 2011, 111).

one association (World Bank 2005, xi). Consolidation takes place in the Chinese poultry sector, as well. From 1996 to 2011, only 25 percent of the initial broiler farms were left (MacLachlan 2015, 35). In fact, China, as well as countries in Central and Eastern Europe represent "gold mines" for multinational meat conglomerates; family farms are being converted into huge meat factories (Emel and Neo 2011, 69).

Who rules the corporatist landscape in the animal-industrial complex? The world's largest meat company (by sales) is JBS SA, a multinational corporation with headquarters in São Paulo (Emel and Neo 2015, 8). JBS has become the world's biggest beef, lamb, and mutton producer, and the world's chief chicken and leather processor. The giant has the capacity of processing the colossal amount of 81,500 cows and 13.8 million birds per day (JBS 2011, 37–39). This comes to 29.7 million cows and 5.037 billion birds per annum (pigs and other animals excluded). In the past years, JBS acquired units of the U.S.-based TysonFood (one of the biggest poultry producers in the world), Smithfield, Cargill Pork, and the poultry producer Malfrig. The multinational meat conglomerate tripled its net revenue from R$ 54.7 billion in 2010 to R$ 162.9 billion in 2015 (JBS 2011, 14)[42], surpassing food giants like Danone or Unilever (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 12), which merited a raised credit rating by three major rating agencies (JBS 2011, 14). In the United States, the acquisition of Cargill Pork allowed JBS USA Pork to daily process 89,500 hogs in just five "pork processing units" (JBS 2011, 45). This equals on average 17,900 slaughtered hogs in one facility per day. In 2015, JBS counted 227,168 employees in over 15 countries, almost doubling its workforce from 2010 (JBS 2011, 33, 2011, 78).

Another example of corporate consolidation in the complex, and of the increasing influence of China, was the 2013 acquisition of the U.S.-based company Smithfield, the world's principal pig producer (by sales), by Shuanghui, China's major meat processor by company value. The rise of Smithfield went hand in hand with the decline of small hog farms in the United States noted above (Carvajal and Castle, May 05, 2009). Acquiring the U.S. competitor gave the Chinese company credibility, production technology, and farms in the United States that raise 15.8 million hogs per year. In China, Shuanghui owns eight slaughterhouses that can process 113,000 pigs per day (Emel and Neo 2015, 8–9). The acquisition of Smithfield "was the largest-ever acquisition by a Chinese company of a U.S. asset." The group has subsequently been renamed to WH Group (MacLachlan 2015, 35).

The ever-increasing concentration is, however, a risky business. Increased risk of health and economic crisis, but also volatile feed prices, especially with rising speculation and biofuels,

42 In 2010, R$54.7 billion equalled 32.9 billion USD. In 2015, 162.9 billion R$ equalled 48.4 billion USD.

constitute some of the downfalls of concentration, against which corporations are trying to protect themselves with insurances tailored to the sector's needs (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 12–13). Yet, for Weis, the systemic problems of industrialized animal production are simply "overpowered" (Weis 2013b, 76).

2.1.3.3 Bodies and species

Not only the animal factories grow, the animals themselves and their "output" get bigger as well. In corporatist jargon, referring to livestock units, this is called a higher "offtake per unit of stock" (Costales, Gerber, and Steinfeld 2006, 24). Between 1960 and 2010, the average carcass weight of beef cattle and chickens has increased by 30 percent. The slaughter weight of pigs has increased by about 20 percent (Thornton 2010, 2854). The breeding industry in the United States achieved even higher averages. In the time span between 1945 and 2001, the average broiler weight increased by 60 percent, from 1,4 kilograms to 2,3 kilograms; and time until the average broiler reaches her or his market weight has been halved (Gunderson 2013, 263). In the 1970s, the average pig in the United States weighted 67 kilograms; today, she or he weights around 100 kilograms (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 10). The pigs reach their slaughter-weight when they are less than six months old (Idel and Reichert 2013, 144).

The global average amount of milk "produced" per cow and the amount of eggs produced per chicken have augmented by roughly 30 percent between 1960 and 2010 (Thornton 2010, 2855). In the extreme case of the United States, though, through breeding and replacing other breeds with Holsteins, productivity more than quadrupled in those five decades (Shields and Orme-Evans 2015, 365) (the importance of genetics will be further examined in paragraph 2.1.4.2).[43] Finally, U.S. laying hens lay around 300 eggs per year (Idel and Reichert 2013, 145).

The industrialization in the complex altered the prevalence of the exploited species, too. The biggest modification is the new predominance of monogastric over ruminant animals. Nowadays, the "top three" animal groups accounting for 90 percent of global livestock production by volume are, in order of importance, pigs, poultry (including a vast majority comprised of chickens, but also ducks, geese, and turkeys), and cows (Steinfeld et al. 2006, 75–76; Weis 2010, 139). Why have monogastric species overtaken ruminants? Pigs and chickens are "good feed converters," they have a smaller environmental impact, faster reproduction cycles, and can (forcibly) be confined in very small space, saving cropland and pasture (Delgado et al. 1999, 17;

43 In more detail, in 1944, a population of 25.6 million dairy cows produced 53.0 billion kilograms of milk, each cow giving 2,074 kilograms yearly. In 2007, however, the U.S. dairy sector produced 84.2 billion kilograms of milk in 2007 with a population of 9.2 million cows, resulting in a milk yield of 9,193 kilograms per individual cow (Shields and Orme-Evans 2015, 365).

MacLachlan 2015, 31). The production of one kilogram of beef needs three times more land than the production of a kilogram of chicken or pig meat, and the greenhouse gas emission of cattle is seven times larger than that of the chicken and pig industries (Shields and Orme-Evans 2015, 372). The chicken industry is also the sector with the biggest potential for economies of scale, as it is the "most easily mechanized".[44] Moreover, chickens are the species whose consumption is not restricted by the major world religions (Steinfeld et al. 2006, 17–18). Boosted by all these advantages, the monogastric sector keeps growing. In South Asia, the number of killed chickens will increase by the factor seven by 2050. In India, the consumption is expected to rise tenfold, mainly in urban areas. Globally, the production of poultry is expected to augment by 25 percent in the decade between 2010 and 2020 (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 40). All those characteristics and the large extent of the sector lead Schneider to define livestock production not as a *food* regime, but as an *industrial meat* regime, as industrial meat—as well as milk or eggs—is not for food, but "for politics, class and capital" (Schneider 2014, 614, 628).

2.1.4 Industrialization: Input

To produce this output of several hundred million tons of dead bodies and secretions, the industry necessitates feed, genetics, pharmaceuticals, and financial and political support. This input is sketched in the following paragraphs.

2.1.4.1 Feeding capital

Before these billions of animals are killed, they have to be raised and fed. As expounded above, livestock was traditionally produced where there was locally available feed. Farmed animals roamed on pastures, consumed crop residues, or household waste. This sort of fibrous feed cannot be consumed by humans and hence did not compete with human food in principle (Costales, Gerber, and Steinfeld 2006, 23). Industrial animal production, conversely, relies on feed grains: the protein-rich diet contributes to a faster weight gain (Delgado et al. 1999, 20; Steinfeld et al. 2006, 12). This is a radical change in feed management. Today, a massive flow of crops is used as animal feed. The most important grains used as animal feed are maize, wheat, barley, sorghum and oats (FAO Commodities and Trade Division 2002). Weis frames the entanglement of the animal-industrial complex with feed production as the "industrial grain-oilseed-livestock complex."[45]

44 Sectors with high labor intensity, like dairy production, are less apt for economies of scale, and often depend on cheap family labor (Costales, Gerber, and Steinfeld 2006, 21–22; Steinfeld et al. 2006, 17).

45 Weis recounts it almost poetically: "The industrial grain-oilseed-livestock complex is the dominant system of agriculture across the temperate world, and is spreading to significant parts of the tropics. Its landscapes can be likened to islands of concentrated livestock within seas of grain and oilseed monocultures, with soaring populations of a

Out of the total estimated global cereal utilization in 2016/17,[46] amounting to 2,564 million tons, 920 million tons or 35 percent were deployed as feed, whereas just a slightly higher amount—1,105 million tons, or 43 percent—was processed as human food (FAO 2016f).[47] And the amount designated for feed is augmenting: in 2011/12, 33.7 percent of the total cereal production was used for feed and 45.3 percent for food (Makkar 2013). Nowadays, more than half of the global maize and 85 percent of the global barley harvest directly end up in feed troughs (Heuzé et al. 2015; Weis 2010, 140).[48] As industrialized production is growing much more than mixed system or pastoral production (consider section 2.1.3), this portion will undoubtedly multiply in the next decades. In addition, monogastric production is propagating much faster than ruminant production; the industrial nourishment of chickens, for instance, consists almost exclusively of cereals and oil seeds (Deutsch, Lannerstad, and Ran 2011, 4). A look at the share of crops used for feed in the Minority World is instructive: In the European Union, 60 percent of the cereal harvest goes into feed troughs, whereas in South Asia and Sub-Saharan Africa, only 10 to 15 percent of cereals are used as feed—yet (Fritz 2014, 5).

In 2000, Delgado et al. (2000, 7) calculated and projected the cereal use for feed for the two periods 1992/94 and 2020, for the Minority and Majority World, for China, and for the world total, as illustrated in figure 5. Cereal use was expected to grow everywhere. Still, whereas it was supposed to grow by 17 percent in the Minority World from 1992/94 to the year 2020, from approximately 442 to 519 million tons, it should more than double in the Majority World—from 194 to 409 million tons. China would use 178 million tons of cereals as feed by 2020, an increase by 143 percent compared to the 73 million tons used in 1992/94. Total use of cereals as feed in the world was projected to climb from 636 million tons in 1992/94 to 928 million tons in

few livestock species reared in high densities, disarticulated from the surrounding fields. These islands of concentrated livestock and seas of monocultures are then rearticulated by heavy flows of crops such as corn/maize, barley, sorghum, soybeans, and rapeseed/canola cycling through animals. This disarticulation and rearticulation is mediated by an array of technologies, inputs, and large corporations, and marked by the loss of large volumes of usable nutrition." (Weis 2013a, 8).

46 Global cereal production in 2016 is forecasted to be 2,577 million tons (FAO 2016f).

47 The remainder is deployed for industrial production such as biofuels, sweeteners, starches, or for brewing (FAO Commodities and Trade Division 2002). The numbers stem from the *FAO Cereal Supply and Demand Brief* of the 8th of December 2016 (FAO 2016f). Unfortunately, this brief is not archived; the homepage solely displays the newest brief. Nevertheless, the reports on "Crop Prospects and Food Situation" of the past years can be retrieved on (FAO Trade and Markets Division 2017). The animal industrial complex's competition for feed versus food and the societal consequences will be debated in chapter 2.4.1.

48 The Global Agenda for Sustainable Livestock, which will be examined in more detail in the fourth and fifth chapter, reassures that cereals constitute less than ten percent of the global livestock feed basket: grass (39 percent), crop residues (26 percent), and agricultural by-products (8 percent) are the main elements of the farmed animals' diet (Global Agenda for Sustainable Livestock 2015a, 43). Nonetheless, if the Global Agenda considers this relatively small share of grains good news, then one should consider that those ten percent do indeed equal 35 percent of the global cereal utilization.

2020. The projections were accurate, yet probably slightly conservative, as already in 2016/17, 920 million tons of cereals were used as feed.

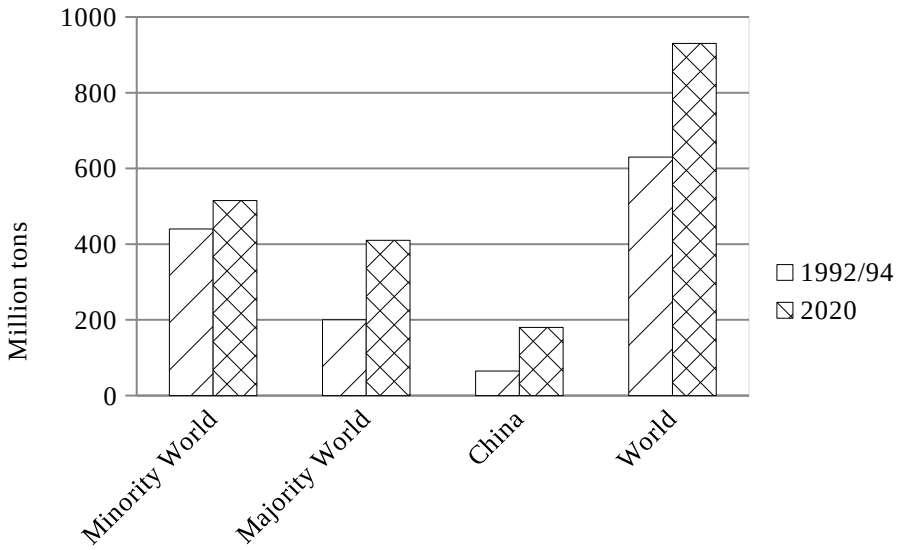


Figure 5: Cereal use as feed, 1992/94-2020.

Adapted from "Responding to the 'Livestock Revolution'—the case for livestock public policies," by FAO, 2005, Livestock Policy Brief 1, p. 3. (http://www.fao.org/ag/againfo/resources/en/pubs_sap.html#). Data from Delgado et al. (2000, 7).

And until now, only cereals were assessed: Oilseeds like soybeans are not included in the figures above. The main part of soybean production goes to farmed animals (Heuzé and Tran 2016; Weis 2013a). Soybeans are used as animal feed mainly in the form of soybean meal which is a by-product of oil extraction (Heuzé and Tran 2016).[49] *Feedipedia*, an open access encyclopedia of animal feed resources set up by the FAO,[50] specifies that soybean meal is "the most important protein source" for livestock, representing "two-thirds of the total world output of protein feedstuffs, including all other major oil meals and fish meal" (Heuzé, Tran, and Sadasivam 2015). In the United States, 98 percent of soybean meal lands in feed troughs (Weis 2010, 140).[51] Soy production will continuously expand, especially in Brazil (OECD and FAO 2015, 4). The demand for soy has been fueled by national bans of feeding slaughterhouse waste, and equally by the incessant expansion of aquaculture (compare paragraph 2.1.5. on the fishing industry) (Heuzé, Tran, and Sadasivam 2015). In total, the production of the two main feed crops maize and soy has grown more than four-fold and more than eight-fold, respectively, since 1961. Yet,

49 Soybean oil is mainly used for human consumption (Heuzé, Tran, and Sadasivam 2015).

50 In collaboration with the Institut National de la Recherche Agronomique (INRA), the Centre de coopération international en recherche agronomique pour le développement (CIRAD) and the Association française de zootechnie (AFZ).

51 Because of its status as a by-product, it is difficult to find reliable numbers on the percentage of global soybean harvest used for feed.

thanks to increased productivity of the crops, the area occupied by maize and soy crops "only" doubled and quadrupled in these five decades (Weis 2013b, 68–69).[52] In Latin America alone, the land dedicated to soy and maize has increased by 94 percent between 1980 and 2004. The crops are mainly deployed for concentrate feed production. In Sub-Saharan Africa, expansion of crop land for cereal production rose by 64 percent, in East and South East Asia by 15 percent (Costales, Gerber, and Steinfeld 2006, 24).

2.1.4.2 Genetics and pharmaceuticals

Another crucial trend in the sector is animal genetics. The expansion of industrialized animal production in the 1950s propelled breeding corporations (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 24).[53] The knowledge about animal bodies, pedigree, and value, once the specialty of experienced farmers, is now produced, governed, and sold by scientists and corporations. This is particularly the case for pigs and poultry. Companies manage their genes and deliver "standard animals" to farms (Holloway and Morris 2008, 1712). New methods and technologies such as molecular genetics are on the rise and are deployed to breed for specific traits such as meat quality and lower environmental impact (Thornton 2010, 2858).[54] One such method is genomic selection: characterized by Holloway as the "geneticization" of breeding, it is a shift from the traditional "breeding by eye" according to aesthetical values (Holloway 2015, 179).[55] Genomic selection is considerably more accurate as traditional pedigree indexes and thus path-breaking for the "genetic improvement of livestock species" (Calus 2010, 157). Through geneticization, farmed animals are completely reduced to their genes, their whole existence is genetically geared towards higher efficiency, farm output, and profit (Holloway 2015, 192).

With this specialized and concentrated mass production, the genetic diversity of farmed animals has become very narrow. Out of the existing 8,000 livestock breeds, a quarter face extinction, while a mere handful of high-yielding breeding lines dominates the market. Those few standardized, highly productive breeds are bred for the controlled environment of CAFOs with stable

52 For both plants, genetic modification is common. In 2008, genetically modified soybeans occupied about 68 percent of the world soybean area (which equalled 65.8 million hectares). The crops are mainly modified for herbicide-resistance. Other traits are salinity- or drought-resistance, or improved nutritional and/or health characteristics (Heuzé and Tran 2016).

53 Selective breeding has been a practice since the domestication of nonhuman animals. Traditional breeding methods include cross breeding, within-breed selection, and breed substitution. With these methods, significant production gains were made in pig and poultry species, and to a lower degree in dairy cows (Thornton 2010, 2858).

54 For a discussion of biotechnology in the animal-industrial complex, see Twine 2010 and Emel and Urbanik 2005, 451.

55 The most important genetic techniques enhancing the "genetic quality" of the breeds are *genetic markers* and *estimated breeding values*. Genetic markers are genetic material gathered in the animal's hair or blood that is associated with specific, heritable traits. More than 50,000 markers have been assessed just for cows (Calus 2010, 158). Estimated breeding values are statistics on the "genetic value" of every individual animal and its progeny. The values encompass desired outcomes like growth, fat and muscle depth, and carcass and meat traits. Governments, agricultural scientists and commercial agencies promote these two techniques as "the way forward" (Holloway 2015, 180).

temperature, light, and moisture, standardized, high-protein feed, and pharmaceutical input (Steinfeld et al. 2006, 13; Heinrich Böll Foundation and Friends of the Earth Europe 2014, 23–25). In the U.S. dairy sector, for example, Holstein cows have a market share of 83 percent. 60 percent of U.S. beef production stems from the breeds Angus, Hereford, and Simmental. Likewise, 75 percent of the global pig meat in market shares stems from three pig varieties. The genetic material of these breeds is controlled, further developed, and marketed by a handful of global breeding corporations.[56] Local breeds are being crossbred to respond to external intensification pressures (Thornton et al. 2009, 119–20). Hybrid lines are getting more important, too, mainly in the chicken and pig sector, both in the Minority and Majority World (Hoffmann 2005). As hybrid animals cannot reproduce, farmers depend on the suppliers for buying new chickens for every "production cycle" (Gura 2008, 3). The genetic erosion and the concomitant vulnerability of the specialized super-breeds are undermining food sovereignty (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 25).

Concentration of breeds and intensification of production on such a scale are not possible without pharmaceutical input, in particular antibiotics. They are administered to livestock in subtherapeutic doses for two reasons: first, to overpower the hostile and draining conditions in CAFOs, and second, to promote growth (Steinfeld 2004, 37).[57] The continuous, low-dose administration of antibiotics has become the normality in the global animal-industrial complex. In China, an estimated 100,000 tons are fed to livestock per annum. In the United States, where farmed animals ingest 80 percent of antibiotics sold nationally, 13,000 tons were administered in 2009 (Cassuto and Saville 2012, 192; Heinrich Böll Foundation and Friends of the Earth Europe 2014, 26–27). If we consider the bigger picture, we end up with the rather absurd situation that antibiotics are fed to healthy animals in the Minority World, whereas livestock in the Majority World lack veterinary care.[58]

With intensification, the administration of antibiotics will also increase, but the practice is contested (Steinfeld 2004, 39). The indiscriminate application of antibiotics has led to the creation of "superbugs," deadly pathogens that are resistant to several antibiotic classes. Those mutated bacteria are spread through both global trade and manure, as this latter is washed into rivers and lakes. Such superbugs constitute a severe health threat and possibly the beginning of a "post-antibiotic era" (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 26-27). Already

56 Likewise, breeding companies control the four big breeds in the aquaculture industry, namely rainbow trout, Atlantic salmon, tilapia, and tropical shrimp (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 24–25) (read more on aquaculture in chapter 2.1.5).

57 Pigs that are fed antibiotics need 10 to 15 percent less feed to reach their market weight (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 26–27).

58 Farmed animals in the Majority World suffer from a wide range of epidemic and endemic disease agents (Steinfeld 2004, 39). In the Minority World, diseases have a 17 percent share of total animal production costs, in the Majority World, they account for more than 35 percent (Chen and Yada 2011, 588).

in 1997, the World Health Organization recommended prohibition of sub-therapeutic administration to livestock, as well as regulation and phasing out of other sub-therapeutic medications such as growth hormones (Thornton 2010, 2860). In 2006, the European Union banned the use of antibiotics as a growth promoter as well as the use of growth hormones; still, the amount of antibiotics fed to animals did not decrease significantly (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 26–27; Thornton 2010, 2860).

2.1.4.3 Subsidies and the power of lobbies

The value of global livestock production systems is estimated at 1.4 trillion USD (Thornton 2010, 2853) which constitutes 40 percent of the global agricultural gross domestic product (Global Agenda for Sustainable Livestock 2015b).[59] In the Majority World, animal agriculture's share of the agricultural gross domestic product is 33 percent; in the Minority World, it represents 53 percent (Thornton 2010, 2853). Nevertheless, without governmental support, most notably exorbitant subsidies, the industry would be in decline. Such state financial incentives are often significantly higher for animal foods than for plant-based foods (Machovina, Feeley, and Ripple 2015, 426). In 2012, the OECD members subsidized the production of beef and veal with an estimated 18 billion USD, 15.3 billion USD went to milk production, 7.3 billion USD were spent for pig meat, 6.5 billion USD for poultry, 2.3 billion USD for soybeans, 1.5 billion USD for egg production, and 1.1 billion USD for sheep (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 20). This totals an estimated 51.8 billion USD in OECD subsidies for the animal-industrial complex for one year. In the European Union, subsidies amounted to 190 USD per individual cow in 2014; in China, they totaled 47 USD per pig in 2012 (Bailey, Froggatt, and Wellesley 2014, 9). In addition, the policy and institutional frameworks in many countries favor large-scale corporations. These privileges include tariff or fiscal incentives and access to subsidized credit (World Bank 2005, 5). To illustrate, the European Union's subsidies allowed Smithfield (now Shuanghui), the biggest producer of pig meat in the world introduced above, to further its expansion and displace small-scale farmers in Eastern Europe and in Africa (Jarosz 2009, 2074).[60]

This benevolent attitude of governments toward the animal-industrial complex is no accident. The political influence of the livestock conglomerates is considerable. One illustration are the steps taken by the meat lobby before the Climate Change Summit COP21 in Paris 2015 which

59 Nonetheless, in 2005, the global livestock sector constituted only 1.4 percent of the world's gross domestic product (Steinfeld et al. 2006, 268).

60 The arrival of Smithfield in Romania lowered the prices for pork and decimated the number of pig raisers by 90 percent in a few years (Carvajal and Castle, May 05, 2009, quoted in Mathias 2012, 1). The giant meat producer raises 600,000 pigs a year in Romania, and gets approximately 30 Euro per pig in yearly subsidies. Add to this 300,000 Euro in cropland subsidies, and 200,000 Euro funding for new European Union states in the year 2008, and you end up with a total of 18.5 million Euro (Carvajal and Castle, May 05, 2009).

were summarized on "GlobalMeatnews.com" (Rowe 2015). The sector feared that the Summit would agree on climate change targets that threatened livestock production. Hence, Huang, secretary general of the International Meat Secretariat, an organization representing the meat industry on an international level (including at the FAO, the World Trade Organization, and in the Global Agenda for Sustainable Livestock, compare 4.2.2.2.2), recognized the need for national meat sectors to "liaise closely with their home governments to ensure the sector did not have unrealistic targets thrust upon it" (Rowe 2016). Huang added:

> *"Our industry is not doing enough to tell its own story. By not talking about what we do to combat climate change we make ourselves an easy target for articulate groups."* [original emphasis].

The solicited "close liaison" apparently worked:

> "Agriculture was the only sector to be specifically mentioned in the final agreement. In Article 2 of the accord, countries sign up to '*increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.'"* (Rowe 2015 [original emphasis]). [61]

The addendum of "in a manner that does not threaten food production" shows the influence of the livestock industry at the Paris roundtable, and it is critical in view of the massive contribution of the sector to climate change. Scurlock, chief energy and renewables adviser at the UK's National Farmers' Union, seems to be content with the victory at the Paris roundtable:

> *"That's the bit we can wave at our governments if they look to introduce measures that make the industry unprofitable. Agricultural emissions are fundamentally different from other sectors. There is no prototype for a genetically modified ruminant that does not produce methane. You can minimise, but you can't abolish the emissions."* [original emphasis].

Commercial alternatives to animal products that undeniably have a much lower ecological footprint (see chapter 2.3) have been reportedly threatened and persecuted by lobbies, with the backing of governmental agencies.[62]

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61 The Article 2 of the climate change accord mentioned here fosters the exchange of technological know-how between the Minority and Majority World and funding of technological innovation in the Majority World. Scurlock, chief energy and renewables adviser at the UK's National Farmers' Union, remarked: *"'There's a recognition that, sooner or later, we are going to have to share our technology with others. There's no gain in us rearing low-methane cows if China's industry has appallingly high rates of methane.'"* (Rowe 2015 [original emphasis]).

62 Such alternatives like plant milk or "vegan eggs" have been fought with legal persecution, banning of market access, patent restrictions, or outright personal intimidation of the companies' founders (The Associated Press 2015; Thielman and Rushe, September 03, 2015).

2.1.5 The fishing industry

For reasons of scope, the fishing industry is not assessed in detail in this account of the animal-industrial complex. Nonetheless, some of its features and trends are strikingly similar to those of animal agriculture and are thus worth considering.

The fishing industry consists of two branches: fisheries and aquaculture. Mood (2010, 72) estimates that 0.97 to 2.7 trillion wild fish are caught each year.[63] The specific number of individual fish is impossible to estimate, because the statistics only list tons of catch. Like in the animal-industrial complex, industrial fleets dominate the business, and industrially caught fish has become a "globalized commodity" (Pauly and Zeller 2016, 2). Mansfield enumerates five characteristics of the ongoing industrialization of the fishing industry: first, the enormous scale of fishing, including the big vessels, the advanced technology, and multinational corporations. Second, the global commodity chains, prioritizing wealthy consumers of the Minority World. Third, industrialization has been encouraged as a form of "development and modernization" by national governments and intergovernmental organizations like the World Bank. Forth, as a consequence, small-scale fishers are being ruled out.[64] Fifth, industrial fishing causes overfishing which is particularly challenging for coastal communities (Mansfield 2011, 84). According to FAO reports, 61 percent of global fish stocks were fully exploited in 2014, and 29 percent were overexploited (Kolding et al. 2016). Mansfield expresses this circumstance as follows:

> "harmful industrial fishing is the purposeful outcome of ongoing efforts to foster a western, capitalist model of development, and this capitalist model of development brings with it new pressures to continue to expand fishing effort even if this leads to degrading the very resource on which the industry depends." (Mansfield 2011, 85).

The second branch of the fishing industry is aquaculture. Aquaculture has multiplied its "yield" tenfold since 1980 (Weis 2013a, 19) and currently produces almost half of the globally consumed dead fish, crustaceans, mollusks, and other marine individuals (FAOSTAT 2015).[65] Strikingly, aquaculture constitutes the "fastest growing animal food sector in the world" (Mans-

63 This number is based on FAO average numbers from 1999-2007 in global fisheries capture of 77 million tons (illegal fisheries and by-catch not included; see equally FAOSTAT 2015; Weis 2013a, 19). Recently, a team of authors scrutinized FAO data, suggesting that Moody's estimate of 0.97-2.7 trillion fish was too conservative (Pauly and Zeller 2016). The authors' calculations reconstruct a global catch of 130 million tons, which declined sharply to around 109 million tons in 2010. This represents an overall quantitative difference of 53 percent. The FAO underestimated small-scale fisheries, recreational fishing, illegal fisheries, and discarded bycatch (Pauly and Zeller 2016, 1–2).

64 Worldwide, 180 million people are involved in the fishing industry, including 44.9 million fishers. 85.5 percent of the fishers are based in Asia, and 9.3 percent in Africa. In the Minority World, fishing firms recruit personnel from abroad (UNODC 2011, 13–14).

65 For 2014, the numbers were 93 million tons of individuals captured while 74 million tons of individuals were killed in aquaculture, summing up to a total of 167 million tons (FAOSTAT 2015). For an overview over the US aquaculture industry, refer to Daniels and McKinney 2015.

field 2011, 87). By 2023, it is expected to supply more than half of the total fish consumption (OECD and FAO 2015, 4). In sum, the trend of intensification and substantial rise in production is dominant in aquaculture, as well. However, Keyzer et al. state:

> "intensification of the production will lead to the same problems witnessed now in intensive livestock production: high feed intensity, problems with animal health, and environmental hazards, such as pollution of the environment through emissions and by animal medication such as antibiotics" (Keyzer et al. 2005, 198).

Paradoxically, aquaculture is equally contributing to overfishing. Why? Aquaculture produces both herbivorous and carnivorous fish. Carnivorous, predatory species are fed with wild fish (Tveterås and Tveterås 2010). To produce one "unit" of such "cultivated," carnivorous fish, like salmon or trout, four to five times more wild fish are required as feed (Keyzer et al. 2005, 198). In total, almost 20 percent of global fish production are fed to carnivorous fish species in aquaculture (UNODC 2011, 15). Keyzer et al. forecast the carnivorous production to expand (Keyzer et al. 2005, 198) which will contribute to an escalation of the biophysical contradictions of the fishing industry.

2.2 Animals and violence

> "The livestock sector provides primary inputs (raw milk, live animals, etc.) to the agricultural and food industry where value adding activities multiply the value of these raw materials." (Steinfeld et al. 2006, 268).

> "In short, industrialized livestock production is a system in which the chronic suffering and acute physical pain of animals are cast outside the realm of rational consideration, instead managed by environmental and bodily manipulations, with scientific, technological, and managerial 'improvements' 'measured solely by profitability' (Mason and Singer 1990, 41)." (Weis 2010, 147).

These two quotes could not be more dissimilar, yet, they delineate the same subject matter: animal production. The first citation stems from the FAO report *Livestock's Long Shadow: Environmental Issues and Options,* the second one from Weis' paper on *The Ecological Hoofprint and the Population Bomb of Reverse Protein Factories*. Both quotations illustrate that for the animal-industrial complex, animals are capital. Their wants and needs literally do not count. Imperative are the needs of capital (Clark 2012, 109). This circumstance gets apparent if one compares the reproduction, birth, short existence and death of farmed chickens, cows and pigs.

They are almost analogous, although these are highly diverse species with diverging ethological needs.

The previous pages have sketched out the political economy of animal protein. This chapter, conversely, is dedicated to the actual "manufacturers" of the commodities in question: the farmed animals. It covers the cruel conditions they have to endure in their short existence, including specialized breeding which leads to a dumping of millions of animals' bodies, "overpowering" with pharmaceuticals, the animals' slaughter, and the suffering inherent to capitalist animal production.

2.2.1 Cruel conditions

For the animals, the animal-industrial complex is, first and foremost, expressed as unimaginable horror and violence, both on a quantitative and qualitative scale. Animal suffering has increased on par with the rise of industrialized, intensive animal farming (Gunderson 2013, 266). The total number of exploited and slaughtered animals has never been so high in history, and the power over the animals' bodies has never been more total than today (Sanbonmatsu 2011b, 29).[66] The intensity of production affects the farmed animals physically and psychologically.[67] As specified in paragraph 2.1.3.3, the average carcass weights of cattle, pigs, and chickens has increased by roughly 30 percent. In the Minority World, this percentage is even more elevated; in the United States, the average broiler weight increased by 60 percent. Furthermore, the broiler's growth rate has more than quadrupled from 1957 to 2015. Nowadays, they reach their slaughter weight in less than five weeks. The average pig weight has risen by 50 percent in the United States, and pig litter size has increased from 7.10 in 1974 to 9.97 piglets in 2011. This proliferation equally led to a higher mortality of piglets. In many countries, breeding sows are kept in gestation crates, metal crates that are just slightly bigger than the sow herself. The crates do not allow the sow to turn around. Her movement is extremely inhibited and she is fed concentrates instead of a high fiber diet, resulting in higher resting heart rates, stress, boredom, and behavioral anomalies or stereotypies. Examples are head-waving, drinker pressing, bar-biting, tail-biting or vacuum chewing. Further, the sows suffer from chronic hunger because of their restricted diet, which is aimed at preventing fat deposition in their confined state The slatted floors cause foot and limb injuries, especially in piglets (Shields and Orme-Evans 2015, 367, 373).

In this day and age, the unnatural, rapid growth of the farmed animals' bodies cannot be borne by their fragile bones, weak organs, and joints, inducing a wide range of chronic illnesses and

66 This occurs in spite of animal welfare legislations or the increasing awareness for animal rights, making the changes achieved by the animal protection movement appear purely symbolic or cosmetic (Sanbonmatsu 2011b, 29).

67 This should not suggest that non-intensive animal husbandry does not affect animals. The topic will be addressed in paragraph 5.5.

injuries. Spending their whole "life" standing or laying in their own excrements (provided they are granted enough space to lie down), especially chickens suffer from lameness,[68] ammonia burns on their eyes, legs, and breasts, and from respiratory diseases. A study by Danbury et al. 2000 (quoted in Gunderson 2013, 263) "objectively" demonstrates that those sentient beings experience constant pain. The researchers offered broilers "normal" feed and feed that contained analgesics. The broilers consistently selected the latter, seeking relief from their suffering. Additionally, broiler chickens undergo metabolic diseases like sudden death syndrome, or ascites. In sudden death syndrome, birds experience acute heart failures, sudden convulsions and wing-beating and are eventually found dead, lying on their backs. Ascites is associated with the incapability of lung and heart to deliver enough oxygen to the fast-growing body (Shields and Orme-Evans 2015, 368).[69]

As stated before, the milk yield per individual cow rose globally by 30 percent; in the United States, it quadrupled. The occurrence of mastitis, a painful infection of the udder and teats, is positively correlated with milk yield, and one of the leading reasons for culling (Shields and Orme-Evans 2015, 366). Furthermore, cows suffer from respiratory diseases, lameness, and from hoof lesions (Rule et al. 2005, 9649; Weis 2013a, 116–20). The ruminants could live more than fifteen years, yet in industrialized systems in the Minority World, their average lifespan is six years (Shields and Orme-Evans 2015, 375). Considering that they have to deliver roughly 10,000 liters during one lactation period, their premature death is understandable (Idel and Reichert 2013, 145).[70]

All farmed animals have to suffer from incarceration, lack of space, crowdedness (or isolation), being kept in darkness for extended periods, sensory deprivation, malnutrition, noise, stress, transportation,[71] and so on. Those factors result in psychological trauma, self-mutilation, and cannibalism (Benz-Schwarzburg and Ferrari 2016, 30; Nibert 2011, 207; Weis 2010, 146). The ethological needs of animals, including spreading their wings, nesting and privacy while laying eggs or giving birth, are continuously compromised. Moreover, some of the animals' physical characteristics are inconvenient for the industry, whether for questions of space, higher risk of cannibalism among farmed animals, elevated danger for workers, or preferences regarding meat

68 Approximately 30 percent of broiler chickens suffer from lameness. Other conditions are *tibial dyschondroplasia* (a skeletal disease that inhibits the tibial cartilage to ossify), *spondylolisthesis* (a slippage of one vertebra relative to another), and even rupture of the *gastrocnemius tendon* (a part of the calf muscle) (Shields and Orme-Evans 2015, 367–68).

69 Additionally, breeding hens are feed restricted to prevent them from suffering from the above-mentioned diseases. This restriction leads to chronic hunger, boredom, aggression, pacing, and pecking at objects (Shields and Orme-Evans 2015, 368).

70 A lactation period is the timespan between two calvings; for the industry, this time span is ideally as short as biologically possible, which is around twelve months (Idel and Reichert 2013, 145).

71 As pointed out in the paragraph on industrialization (2.1.3), the growing trade in livestock products and the metabolic rift in the animal-industrial complex entail longer transportation times.

quality and taste, and are therefore brutally removed. For example, hens are de-beaked, cows are dehorned, the piglets' tails are docked and their teeth severed, male piglets are castrated. All these mutilations are generally performed without anesthetics (Gunderson 2013, 263–65).

Intensification often implies also less human workforce responsible for an ever-increasing number of animals. In general, individual veterinary care is not provided, health is a topic just at the herd or flock level. This is not surprising if one imagines that one sole employee can be responsible for 8,000 pigs per day. The consequence is that animals who are sick will go unnoticed and have to suffer until they die. The picking-up of dead chicken is described as being "one of the main daily tasks" of a worker at an industrial grow-out broiler facility (Shields and Orme-Evans 2015, 372–74).

2.2.2 Specialization until worthlessness

The highly-specialized branches of animal production take their toll. Two different breeding lines have developed for species exploited for both their meat and their eggs or their milk, namely, chickens and cows. Chickens are separated into broilers and laying hens; cows into dairy cows and "beef cattle." Fifty years ago, this was not the case. To illustrate, chickens have been mainly reared for their eggs, not for their meat. Today, the broiler industry is a fast-growing industry, with its own breeds that are poles apart from the physiognomy of a layer hen (Gunderson 2013, 263–65). The repercussions of such selective breeding are that the male offspring in the egg and dairy industry, incapable of producing eggs or milk, is useless. Hence, all male chicks, unusable in the laying hen industry, are annihilated in hen hatcheries—yearly hundreds of millions of them are gassed, trashed, or chaffed out of their economic worthlessness (compare paragraph 2.1.4.1 on "hatchery by-product") (Gunderson 2013, 263; Weis 2013a, 112–13). Young male calves, so-called "surplus calves" (Gerber et al. 2013, 26), similarly useless in the dairy industry, are sold to slaughter after around eighteen weeks of existence (Gunderson 2013, 264). Another condition in the rearing of the animals, linked to those specialized breeds, is the ceaseless (artificial) impregnation of the female farmed animals. Artificial insemination is the norm in the industry, since copulation has become physically impossible for turkeys, broiler chickens, and for the majority of pigs, too. Dairy cows, once they deliver their children, are commonly almost immediately separated from them (Gunderson 2013, 263–65; Weis 2010, 146).

2.2.3 Overpowering

In the United States, more than fifty percent of all pigs are kept in operations that consist of more than 5,000 pigs. More than half of layer hens are kept in operations that comprise more than 100,000 birds (Casey et al. 2015, 259), and 99 percent of layer hens are reared in facilities

with 10,000 chickens or more (Weis 2010, 140). As demonstrated in subsection 2.1.4.2, factory farms can only perpetuate this violent and excruciating enterprise with the massive usage of antibiotics, feed additives, chemical pesticides, and disinfectants (Gunderson 2013, 263). This "overpowering" (Weis 2013b, 76) is a cruel experience for the farmed animals.

The administration of growth hormones has resulted in animal welfare concerns such as lameness, foot problems, horn overgrowth, or reduced fertility. An alternative is disrupting the *myostatin* gene to increase muscle growth (Laible 2009, 132). An already existing breed with a mutated *myostatin* gene is the breed Belgian blue. These animals have a natural mutation of the *myostatin* gene which leads to uninhibited muscular growth, resulting in an increase of muscular masses and fibers. For meat production, the breed is valued for the "higher dressing percentage" and "tenderness" of the flesh (Colombino and Giaccaria 2015, 163, 174). However, the calving difficulties of these breeds lower their economic competitiveness (Laible 2009, 132).

β-adrenergic agonists, a growth-promoting medication fed to cattle, has been observed to cause behavioral change and higher death rate among cows. Pigs that are administered β-adrenergic agonist ractopamine hydrochlorides suffer from aggression, hoof lesions, and difficulties walking and standing. Recombinant bovine Somatotrophin (rbST) is a growth hormone administered to cows to boost milk yield. The drug is associated with an increased risk of mastitis (Shields and Orme-Evans 2015, 370–71).

2.2.4 Killing

The killing of the farmed animals is managed in the most efficient, fastest, and cheapest way possible, with the animals paying the price for it. Many beings are slaughtered while still conscious because processors chose the most economical killing methods. In the electrical stunning of chickens,[72] for example, low current is applied instead of more expensive, higher current (Gunderson 2013, 263–65; Nibert 2011, 208). Higher current that would more "effectively" kill the birds also induces hemorrhaging and bone breakages. Both have economic penalties: the first decreases meat quality, the latter complicates carcass processing (Higgin, Evans, and Miele 2011, 186). If insufficiently stunned, the conscious birds, shackled upside down, witness how their jugular veins are cut and how they are transported into scalding water to have their feathers removed (Morin 2016, 6). Nor does captive bolt stunning of cattle[73] always suffice to render the

72 For more information on poultry stunning see Berg and Raj (2015). At the end of their existence, laying hens are "disposed of" or converted into biogas (Gunderson 2013, 264; Massé, Talbot, and Gilbert 2011).

73 Captive bolt stunning of cattle was invented in 1903. The stunning of smaller animals like pigs, sheep, and chicken was commercialized and advanced through electric stunning techniques in the beginning of the twentieth century. It made the work of the slaughterer much safer and easier and reduced the "needless" suffering of the animal. The insight into how electric stunning could produce such a state of unconsciousness was gained in the "medical" procedure of electric shock treatment (Higgin, Evans, and Miele 2011, 177).

animal unconscious. The fast processing pace in slaughterhouses occasions careless stunning. The worker often does not apply sufficient power, or shoot from the correct angle or at the right spot. The cow is then cut into pieces while still cognizant (Morin 2016, 6).

2.2.5 Systemic violence

It is imperative to note that the culprits of those horrors are not a handful of malicious slaughterhouse workers, some avaricious corporations, or even the lack of law enforcement. The capitalist system itself is geared towards profit maximization which will always happen on the backs of the animals (and of the employees, as well, as will be elaborated in paragraph 2.4.4) (Gunderson 2013, 267). Animal suffering is inscribed in capitalist production. In order not to lose customers, the complex tries to disguise this fact with cosmetic animal welfare policies.[74] The primary motive for such policies is reducing non-compliance (compare the paragraph on instrumentalizing animal welfare 5.5.2). For instance, animal mothers should be stopped from screaming for their babies after their separation. To reach this goal, the industry has begun to investigate methods of ablating the animals' anterior cingulate cortex, the region of the brain responsible for emotions, which would turn them into numb machines (Terhaar 2012, 68).[75] In sum, not only do animals have to exist inside factories, surrounded by machines, they also have to be functional like machines and ultimately *have become* machines themselves (Sanbonmatsu 2011b, 24–25).

2.3 Ecological hoofprint: Crossing of planetary boundaries

Compared to the environmental repercussions of animal agriculture and its use of grain for fodder (namely 35 percent of the global harvest), fracking or the production of biofuels look like Disneyland fantasies. Even the FAO asserts that "[u]ltimately, if left unchecked, environmental degradation may threaten not only economic growth and stability but the very survival of humans on the planet." (Steinfeld et al. 2006, 6).[76] This chapter illustrates the ecological hoofprint of the animal-industrial complex with the planetary boundaries-model.[77] In 2009, and with an

74 One example of such welfarist whitewashing is the previously mentioned corporation JBS, the world's biggest beef, lamb, and mutton producer, and the world's chief chicken processor, with daily processing capacities of 81,500 cows and 13,8 million birds (see chapter 2.1.3.2 on JBS). In its 2015 annual report, JBS assures that every single animal is slaughtered in line with "animal wellbeing guidelines" (JBS 2011, 76–81). In addition, JBS claims to respect the "five freedoms," a formalization of five aspects of farmed animal welfare: "1. Freedom from fear and stress; 2. Freedom from hunger and thirst; 3. Freedom from discomfort; 4. Freedom from pain and illnesses; and 5. Freedom to express normal behavior" (JBS 2011, 60).

75 Shriver (2009) investigates the ethics of genetically creating "knockout animals." Refer as well to his New York Times article "Not Grass-Fed, but at Least Pain-Free" (Shriver, February 19, 2010).

76 An insightful new publication on the issue is Raphaely and Marinova 2016, entitled "Impact of meat consumption on health and environmental sustainability."

77 The planetary boundaries-model has faced scientific (Blomqvist, Nordhaus, and Shellenberger 2012) as well as political criticism. From the scientific side, it is contested that environmental change is always non-linear, that everything is connected, or that the extinction of some species necessarily affects an ecosystem, among others. On the political side, it is claimed that such boundaries should be the object of a collective, societal discussion. Their defi-

update in 2015[78], environmental scientists identified and quantified a set of nine "planetary boundaries" within which humanity can continue to live for generations to come (Rockström et al. 2009; Steffen et al. 2015), compare figure 6. Crossing these boundaries engenders irreversible environmental changes.

nition depends on societal priorities (for instance, why is biodiversity valuable?), and is therefore normative (Rayner 2013). Environmental problems always have a social component. Global standards for local problems can seem senseless; for instance, while some countries are using too much fertilizer, other countries desperately need more. To politically discuss a boundary on a local level would be much more significant (Pielke 2013).

The planetary boundaries team has responded to the criticism, for instance, their 2015 update operationalizes local boundaries (Steffen et al. 2015). In terms of politics, the team states that whereas the exact boundary position was a social choice, "the range is based on an Earth System analysis" (Rockström 2015). Galaz from the Stockholm Resilience Centre affirms that the boundaries "can be quite powerful political constructions that mobilize political action." Similarly, Liverman, coauthor of the planetary boundaries paper, asserts that limits can inspire "redistribution and innovation" (Lalasz 2013). But more fundamentally, the team explains that it is not their aim to locate a culprit, or to dictate the direction of societal change (Steffen et al. 2015, 736). Quite politically, they declare that their framework does not

"take into account the deeper issues of equity and causation. The current levels of the boundary processes, and the transgressions of boundaries that have already occurred, are unevenly caused by different human societies and different social groups. The wealth benefits that these transgressions have brought are also unevenly distributed socially and geographically. It is easy to foresee that uneven distribution of causation and benefits will continue, and these differentials must surely be addressed for a Holocene-like Earth-system state to be successfully legitimated and maintained." (Steffen et al. 2015, 1259855–58).

This thesis uses the planetary boundaries model as a tool of discussion and illustration of the environmental impact of the livestock industry because, while it is true that the relationship between human activities and the biosphere is to be determined on a local level and in a collective way, the model nevertheless reminds us of the all-encompassing global dimension. It makes explicit that the Earth is a closed, finite system, that endless growth is impossible, and that there is an urgent need for change. The model firmly and unequivocally posits the biosphere as "the basis for human wellbeing" (Rockström 2015), and, as such, in the center of politics. Further, the model's multidimensionality and broad international acceptance champions its shortcomings.

It is imperative to clarify here that the author's own, first exploration of the issue is by no means exhaustive. This assessment might also differ from other investigations depending on the data they rely on. An in-depth analysis from natural science experts would be a precious contribution to the ongoing debate. Besides, the majority of the cited studies do not reflect the author's own stance on animal agriculture.

78 The update includes, among other elements, the introduction of a two-tier framework; the establishment of regional boundaries for biosphere integrity, biogeochemical flows, land-system change, and freshwater use; the quantification of one regional boundary for atmospheric aerosol loading; and the identification of two "core" boundaries: climate change and biosphere integrity (Steffen et al. 2015, 736).

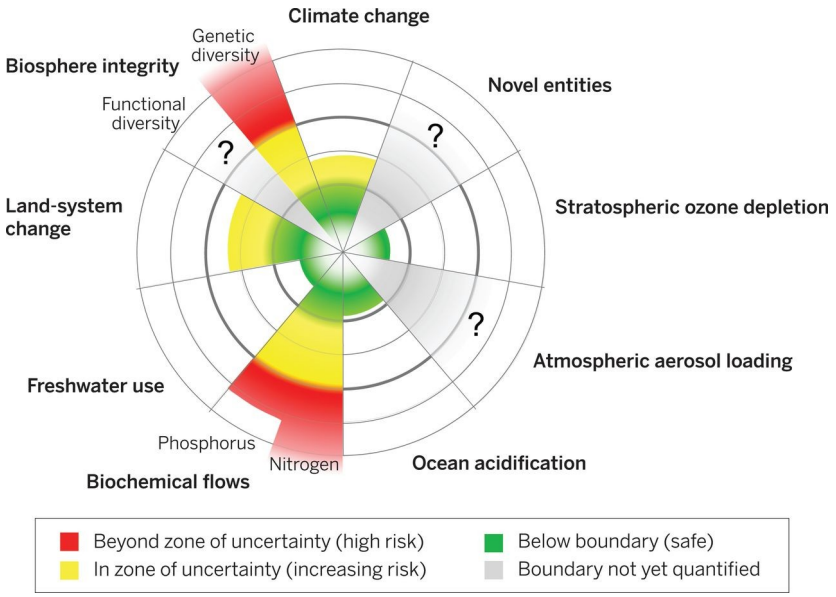

Figure 6**: Planetary boundaries**.

Reprinted from "Planetary boundaries: Guiding human development on a changing planet," by Will Steffen et al., 2015, *Science* 347 (6223), p. 736. Copyright 2015 by The American Association for the Advancement of Science. Reprinted with permission.

The "safe operating space" is marked by boundaries "for anthropogenic perturbation of critical Earth-system processes." The buffer between the boundary and the threshold accounts for uncertainty (Steffen et al. 2015, 1259855-1).

The nine boundaries are climate change, change in biosphere integrity (biodiversity loss and species extinction), stratospheric ozone depletion, ocean acidification, biogeochemical flows (phosphorus and nitrogen cycles), land-system change, freshwater use, atmospheric aerosol loading, and the introduction of novel entities. Four out of the nine planetary boundaries—namely, climate change, change in biosphere integrity, land-system change, and biogeochemical cycles—have already been crossed due to anthropogenic influence, with the animal industry as one of the main causes.

2.3.1 Climate change

The contribution of animal production to climate change is particularly alarming. However, what exactly is understood by "climate change" or "global warming?" The Intergovernmental Panel on Climate Change (IPCC), perhaps the most respected international scientific authority on climate change, assesses global warming in terms of global mean surface temperature change by the end of the twenty-first century. The chosen reference period is the pre-industrial period of 1850 to 1900. The Intergovernmental Panel on Climate Change has calculated four emission scenarios, or Representative Concentration Pathways (RCPs): RCP 2.6, RCP 4.5, RCP 6.0 and

RCP 8.5.[79] The lowest emission scenario RCP 2.6, in which global warming would unlikely exceed two degrees Celsius, is getting ever more unrealistic to achieve. For the scenario RCP 4.5, warming will exceed two degrees Celsius with medium confidence. In the two scenarios RCP 6.0 and RCP 8.5, the global mean temperature will exceed two degrees Celsius with high confidence (IPCC 2014b).

Limiting global warming to two degrees Celsius is a widespread consensus. What does an increase of two degrees Celsius of the global mean temperature signify? It is important to bear in mind that those two degrees are a mean value. In some areas, warming will be much higher than two degrees Celsius; likewise, warming is higher over land than over oceans. Climate zones will be shifting: for example, subtropical zones will expand to the Mediterranean, southern Africa, the southern United States, and South America (Hansen et al. 2013, 6–7). This entails adverse conditions for agriculture, such as floods, droughts, and salinity (Fish, Winter, and Lobley 2014, 53). In particular, in Turtle Island, Northern Europe, the Mediterranean basin, and Northern and West-Central Asia, warmer temperatures of one to two degrees Celsius will negatively influence crop production. However, the Majority World will be most affected. Yield losses due to heat and drought in the tropics and subtropics will be around 10 to 20 percent by 2050, and even higher in some regions (Nardone et al. 2010). The situation will be drastic in Sub-Saharan Africa (Thornton et al. 2009, 114).

Wild animals will be forced to adapt: in point of fact, three-quarters of marine species have already moved their habitat poleward (some up to 1000 kilometers); half of terrestrial species have shifted their ranges poleward (up to 600 kilometers) and upward (400 meters). If global mean temperature is warming 2.9 degrees Celsius, 21 to 52 percent of all species are projected to go extinct. Shifting climate zones are equally threatening to indigenous communities and their way of life, bound to a specific land. In the Arctic region, shorelines are eroding, sea ice and tundra melting. The melting arctic ice is a particular threat because it entails sea level rise and the break-up of the white Arctic thermal shield.[80] For Hansen et al., it is a question of time when global coastlines start to be submerged, affecting hundreds of coastal cities, and hundreds of millions of people (Hansen et al. 2013, 1, 6-7). Finally, climate change does not only entail warming, but also an escalation in extreme weather events like hurricanes or droughts (IPCC 2014b).

79 The numbers 2.6, 4.5, 6.0, and 8.5 stand for different radiative forcing values (in Watt per square meter) by 2100 relative to the reference value. RCP 2.6 corresponds to an atmospheric carbon dioxide concentration of 421 parts per million (ppm), RCP 4.5 for 538 ppm, RCP 6.0 for 670 ppm, and RCP 8.5 for 936 ppm (IPCC 2014b).

80 The white ice has an important function in reflecting sunlight. Once broken up, the dark water absorbs the light, and warms up, which advances global warming. This melting will spur long-lasting and irreversible reactions. The sea level can rise by several meters (Hansen et al. 2013, 1, 6-7).

What role, then, does the animal-industrial complex play in climate change? The industry is responsible for 14.5 to 51 percent of global greenhouse gas emissions (Gerber et al. 2013; Goodland and Anhang 2009).[81] Although the exact percentage varies from study to study, even the conservative estimate of 14.5 percent surpasses the emissions of the global transport sector and of the United States: the complex emits 7.1 gigatons of carbon dioxide equivalents per annum ($GtCO_2e$) (Gerber et al. 2013, xii), while the emissions of the transport sector in 2010 were 7.0 $GtCO_2e$ (IPCC 2014a, 7–8).[82] The total emissions of the United States were 6.1 $GtCO_2e$ in 2011 (Bailey, Froggatt, and Wellesley 2014, 4). In addition, animal farming emits 80 percent of total agricultural emissions (Steinfeld et al. 2006, 112).[83] In terms of the planetary boundary "climate change," the animal industry had a share of 52 percent of the suggested safe operating space for greenhouse gas emissions in the year 2000 (Pelletier and Tyedmers 2010, 18372).[84]

Three greenhouse gases dominate the sector's emissions. The biggest impact, namely 44 percent, is from methane gas (CH_4). Methane is mainly created in enteric fermentation (namely, the digestive process), manure, and rice feed. The exploitation of livestock, particularly ruminants, is actually the principal source (40 percent) of anthropogenic methane emissions (Jarosz 2009, 2073; Ripple et al. 2013, 2). Nevertheless, this enormous contributor is relatively neglected, despite the fact that the potential to rapidly reduce the radiative forcing of methane is particularly significant.[85] The second largest contribution is from nitrous oxide (N_2O) (29 percent), a gas which is formed from manure and the (over-)application of nitrogen as fertilizer on crop fields. The third component of emissions is, finally, carbon dioxide (27 percent). The gas stems mainly from land-use change and the use of fossil fuels (Ripple et al. 2013, 2).

Accordingly, not every production stage in the animal-industrial complex emits the same gas or the same amount of it. Feed production and processing account for 45 percent of total emissions, enteric fermentation from ruminants for 39 percent, manure storage and processing for ten percent. Transport and processing of animal foods account for the remainder (Gerber et al. 2013, xii). Still, the emissions of diverse livestock products vary greatly: beef accounts for 41

81 The emission percentages are calculated in carbon dioxide equivalents (CO_2e).

82 The IPCC calculates 49 (±4.5) $GtCO_2e$ total global greenhouse gas emissions for 2010. These are split in the energy supply sector (35 percent, 17 $GtCO_2e$), in agriculture, forestry and other land use (24 percent, 12 $GtCO_2e$, net emissions), in industry (21 percent, 10 $GtCO_2e$), in transport (14 percent, 7.0 $GtCO_2e$) and in buildings (6.4 percent, 3.2 $GtCO_2e$) (IPCC 2014a, 7–8).

83 However, the calculation of the contribution of agriculture to global emissions varies according to the inclusion of variables. One estimate is 17-32 percent (Bellarby et al. 2008, quoted in Pelletier and Tyedmers 2010). The IPCC's estimate is 10-12 percent, however, the IPCC does not account for land conversion effects (Pelletier and Tyedmers 2010).

84 Pelletier and Tyedmers (2010) work with the planetary boundaries assessment of 2009 (Rockström et al. 2009). The safe operating space is limited by the boundary value of an atmospheric carbon dioxide concentration of 350 parts per million, with a zone of uncertainty ranging to 550 parts per million (Rockström et al. 2009). This corresponds to a global warming of two degrees Celsius over the pre-industrial level (Steffen 2012).

85 Methane has a shorter atmospheric lifetime than carbon dioxide (Ripple et al. 2013, 2).

percent of total emissions, cow milk for 20 percent, pig meat for nine percent, and poultry meat and eggs for eight percent respectively (Gerber et al. 2013, xii). The exploitation of ruminants thus has the most significant carbon output, and within the ruminant group, emissions from cattle are substantially higher than emissions from sheep, goats, or buffalos (Ripple et al. 2013, 2).

The mammoth "climate hoofprint" is ever more problematic as there is widespread evidence on much more ecological, healthy, and cheap plant-based alternatives. Hallström et al. provide the first systematic review of English peer-reviewed studies on the environmental impact of dietary change from 2005 to 2014 (Hallström, Carlsson-Kanyama, and Börjesson 2015). According to the fourteen reviewed studies,[86] the shift to a vegan diet has the largest benefits in terms of reducing greenhouse gas emissions and land use demand, with reductions up to 50 percent of the reference value.[87]

Ripple et al. (2013) show that the greenhouse gas hoofprint of beef and other ruminant meat is on average 19 to 48 times higher than the footprint of vegetal meat substitutes or pulses. Though meat from monogastric species such as pigs or chickens has a relatively low hoofprint, it is on average still three to ten times greater than the one of plant foods (Ripple et al. 2013, 3). And even the Intergovernmental Panel on Climate Change states in its Fifth Assessment Report that most plant-based foods have a substantially smaller carbon footprint than animal foods (Smith et al. 2014, 839).

2.3.2 Change in biosphere integrity

The animal industry is the single largest cause of species extinction and habitat loss (Machovina, Feeley, and Ripple 2015). The complex erodes biodiversity through various and mutually multiplying forms on a local and global scale. It reduces, fragments, and completely destroys habitats of wild animals through either direct or indirect environmental degradation (Weis 2013a, 19). Direct impact includes deforestation for grazing or crop land, the application of fertilizers and pesticides, competition between feed crops and native plants and between livestock and wildlife, as well as transmission of livestock diseases to wildlife, and finally, grazing, trampling, and defecation by farmed animals (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 23; Herrero et al. 2009, 118). Indirect impact includes climate change—globally generated yet locally noticeable –, water and air pollution, overfertilization, and changes in bio-

86 The fourteen studies are Arnoult et al. 2010; Aston, Smith, and Powles 2012; Berners-Lee et al. 2012; Fazeni and Steinmüller 2011; Hoolohan et al. 2013; Meier and Christen 2013; S. Pathak et al. 2010; Risku-Norja, Kurppa, and Helenius 2009; Saxe, Larsen, and Mogensen 2013; Temme et al. 2013; Tukker et al. 2011; van Dooren et al. 2014; Vieux et al. 2012. With the exception of the Indian investigation (Pathak et al. 2010), all publications scrutinize European diets.

87 The environmental impact of processed meat alternatives like tofu or tempeh has been investigated in several studies, see Hallström, Carlsson-Kanyama, and Börjesson 2015, 7.

geochemical cycles. Species that are not able to adapt to changed conditions have to migrate or will simply perish (Weis 2013a, 20).

2.3.3 Land-system change

Checking the boundary land-system change, livestock systems cover virtually inconceivable 45 percent of global land surface (Thornton, Herrero, and Ericksen 2011, 1). The majority of this area is used for grazing (Global Agenda for Sustainable Livestock 2014b, 6). This makes the animal-industrial complex the largest land user on Earth (Herrero and Thornton 2013, 20880). In regard to agricultural land, and not land surface, the complex occupies 78 percent of all agricultural area (Global Agenda for Sustainable Livestock 2014b, 6; Steinfeld et al. 2006, 74). The boundless spatial extent of the animal-industrial complex is particularly worrisome as its spread does not match its productivity. The complex, with its four-fifths of agricultural land, yields in terms of global consumption, a quarter of proteins, and a mere 13 percent of calories (Global Agenda for Sustainable Livestock 2014b, 2). The gigantic extent of the industry prompts even more questions as a nutritious vegan diet would reduce land use by up to 50 percent (Hallström, Carlsson-Kanyama, and Börjesson 2015, 3).

Almost half of global land surface has not always served as pasture or cropland. In 1850, only fourteen percent of all land was cropland and pastures (Deutsch, Lannerstad, and Ran 2011, 4). In the past century, great areas of land and forests have been cleared and "indulged" by the animal-industrial complex. Cattle ranching in particular is responsible for 65 to 80 percent of Amazon deforestation (Emel and Neo 2011, 70; Herrero et al. 2009, 114). In view of this massive extent of the livestock industry, Schneider developed the thought-provoking concept of "meat grabbing" in reference to already established term "land grabbing" (Schneider 2014, 614).[88]

The land used for industrial livestock and feed production is completely degraded after a certain period (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 31).[89] Besides, existing pastures are often overgrazed, entailing desertification and biodiversity loss (Deutsch, Lannerstad, and Ran 2011, 4). Nonetheless, the conversion of new land into cropland or pasture cannot go on forever. Land is a limited resource. As Europe and the United States have already con-

88 Schneider defines the meat grab as follows: "Meat grabbing describes actually existing land deals undertaken for industrial meat production, either directly in the form of animal housing and stocking (confined animal feeding operations, or CAFOs), or indirectly in the form of monocrop grain and oilseed production for livestock feed. Meat grabbing is also a concept for analyzing the relationships between industrial meat regimes, food security politics and the global land rush, relationships which have not yet been sufficiently considered in research or in policy. By focusing on the ways in which these relations are obscured in food security narratives, the politics and dispossessions that drive meat grabs and the uneven distribution of their socio-ecological implications, the concept adds complexity and further specifies the categorization of food-related land deals" (Schneider 2014, 614).

89 Researchers suspect heavy machinery is one major culprit, among others, in the reduction of the content of organic matter in the soil (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 31).

verted much of its grassland, savannah and scrubland into agricultural land, they engage in a "virtual land trade" by feeding themselves on the produce of the Majority World.[90] In 2010, the European Union has imported soybeans grown on approximately 16 million hectares, out of which 12.8 million are located in South America (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 30–31). Taking account of these numbers, the calls for grassland and ecosystem protection issued by the Minority World—a topic to be explored in depth in sections 5.4 and 5.7.4—seem cynical. The Minority World has already destroyed a large share of its resources and now asks the Majority World not do to so in its own interest.

2.3.4 Biogeochemical flows

Animal agriculture is the main driver of nitrogen[91] and phosphorus[92] cycles in agriculture and the primary user worldwide of reactive nitrogen as fertilizer (Sutton et al. 2011b). Pelletier and Tyedmers calculate a share of 63 percent of global reactive nitrogen mobilization for the animal industry for 2000 (Pelletier and Tyedmers 2010, 18372).[93] If one considers the gigantic area occupied by the complex, these figures are probably a bit more comprehensible. Yet, the intensification of animal production has led to a disruption of the nitrogen and phosphorus cycles for two reasons (FAO 2011b, 31; Herrero and Thornton 2013, 20880). First, the separation of feed production and animal production (the metabolic rift, see section 2.1.3) prompts a massive overabundance of manure—literally heaps of shit—near CAFOs, and requires artificial fertilizer for crop fields in other places (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 31).[94] In other words, there are nutrient concentrations in some areas and nutrient deficits in other areas (Deutsch, Lannerstad, and Ran 2011, 7; Herrero and Thornton 2013, 20880). The lo-

90 Approximately 28.5 percent of European grassland, savannah and scrubland have been converted into pasture and cropland. In the United States, a slightly higher amount of land, 30 percent, is pasture and cropland. In Africa, 24.5 percent have been converted, and in Asia, only 7.5 percent (own calculation based on Heinrich Böll Foundation and Friends of the Earth Europe 2014, 31).

91 Nitrogen gas is a natural element of the Biosphere and can be fixated by plants. In the beginning of the twentieth century, the German chemists Haber and Bosch invented the synthetic fixation of atmospheric nitrogen (N_2), henceforth called the Haber-Bosch process. The Haber-Bosch process converts atmospheric, unreactive nitrogen into its reactive form (N_R). This reactive form encompasses the forms nitrogen oxide (NO_x), nitrous oxide (N_2O), ammonia (NH_3), and nitrate (NO_3) (Sutton et al. 2011b, 160). Reactive nitrogen is used as chemical fertilizer. In principle, an unlimited amount of nitrogen can be fixated through the synthetic process; however, the procedure itself is energy-intensive and costly. Still, the amount of synthesized nitrogen fertilizer has increased from 10 million to 80 million tons between 1960 and 1980 (Deutsch, Lannerstad, and Ran 2011, 7–8). This anthropogenic fixation has doubled global rates of total nitrogen fixation which primarily comprises biological fixation by bacteria in plants (Sutton et al. 2011b, 160).

92 Phosphorous is a key fertilizer for crops. Yet, in contrast to nitrogen, phosphorus is a non-renewable, limited resource (Deutsch, Lannerstad, and Ran 2011, 8), and its access is increasingly difficult and costly (Kahiluoto et al. 2014, 17). Phosphorus is either absorbed in plants, or gained by mining phosphate rock. Between 1960 and 1980, phosphate mining has increased from approximately 35 million tons to 150 million tons (Deutsch, Lannerstad, and Ran 2011, 7).

93 In a less conservative estimate, Liverman states that 80 percent of global nitrogen production are deployed for meat production (Lalasz 2013).

94 The annual damage related to reactive nitrogen in the EU27 countries ranges between 70 and 320 billion Euro (Brink and van Grinsven 2011, 513), which exceed the total profit made in EU agriculture (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 20).

cal nutrient surplus is not being recycled: globally, more than 80 percent of nitrogen and phosphorus applied as fertilizers are lost due to inappropriate manure management (Deutsch, Lannerstad, and Ran 2011, 7). Second, industrial livestock systems deploy more fertilizer-intensive oilseeds as feed, instead of feed gained from pastures (Bouwman et al. 2013, 20882; Hedenus, Wirsenius, and Johansson 2014, 85).

What happens to overabundant nitrogen and phosphorus? Nitrogen returns to its gaseous or soluble ion form and moves to the atmosphere or to water bodies. Too much nitrogen in the atmosphere forms nitrous oxide which contributes to climate change (Deutsch, Lannerstad, and Ran 2011, 7). Phosphorus is accumulated in soils, but erosion precipitates run-off into water bodies. The two elements then impact the ecosystem. Nutrient overload in water bodies provokes eutrophication, toxic algae bloom, and, ultimately, anoxic bottom waters. Additionally, overfertilization of the land contributes to its incapacity to filter rainwater and, eventually, to land erosion. Lastly, nutrient overabundance is one important origin for habitat loss (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 20–22).

The present conversion rate of nitrogen exceeds its planetary boundary excessively. The animal industry's share of the safe operating space for reactive nitrogen mobilization was 117 percent as of 2000 (Pelletier and Tyedmers 2010, 18372). To return to the safe operating space, the conversion rate of nitrogen would have to be reduced by 75 percent (Pelletier and Tyedmers 2010, 18372; Rockström et al. 2009). For phosphorus, the boundary is around a tenth of the present phosphorus flow; however, the estimates largely differ here. A return within the boundaries while continuing current diets and agricultural practices would reduce the available calories per capita and day by over 90 percent. In contrast, a shift to a vegan or vegetarian diet and reductions in food waste (compare footnote 107) would liberate a significant amount of calories lost in animal production (Kahiluoto et al. 2014, 16–19). Environmental physicist Sutton and his colleagues comment in the journal *Nature* that "[i]f Europeans obtained all their protein from plants, only 30% of the crops grown currently would be needed, reducing nitrogen fertilizer inputs and the associated pollution by 70%" (Sutton et al. 2011b, 161).[95] To understand this evaluation, it is helpful to compare the grams of nitrogen needed to obtain plant-based versus animal-based calories: The production of one megacalorie of rice, wheat, or potatoes necessitates one gram nitrogen.[96] Conversely, producing one megacalorie of dairy, poultry, pork or eggs requires three grams of nitrogen, and one megacalorie of beef even demands 19 grams of nitrogen (Eshel et al. 2014, 11998). In consequence, environmental scientist Bouwman et al. call livestock production "inherently inefficient" compared to crop production (Bouwman et al. 2013, 20886).

95 The insights led Sutton and other authors of the European Nitrogen Assessment (Sutton et al. 2011a) to craft the "Barsac Declaration" for a reduced consumption of livestock products (NinE et al. 2011).

96 One megacalorie is equivalent to 1,000 kilocalories.

2.3.5 Ocean acidification

Ocean acidification is primarily caused by the increase of carbon dioxide in the atmosphere which is then dissolved in sea water (Raworth 2012, 17), yet also by nutrient overabundance (Eshel et al. 2014, 11996). As pointed out above, industrial livestock operations have broken the nutrient cycles, they store immense amounts of waste in tanks and lagoons, and excessively apply slurry and manure on fields. Discharges and agricultural run-off pollute the groundwater and streams (FAO 2005, 6). Thereupon, nitrogen and phosphate nurture micro-organisms in the water and foster algae bloom. Those algae, plants and bacteria significantly reduce the oxygen content of the water. Fish and other animals can barely survive. Hence, such overfertilization and concomitant ocean acidification create ocean "dead zones" (hypoxic zones)—among others, in the Mississippi River Basin, the South China Sea, the Caspian Sea, the Baltic Sea, along the Spanish coast, and the Italian Adria (Emel and Neo 2011, 73; Heinrich Böll Foundation and Friends of the Earth Europe 2014, 22).

2.3.6 Freshwater use

With respect to the boundary freshwater use, the complex consumes a third of global freshwater resources yearly. This water is almost completely applied in feed production (Mekonnen and Hoekstra 2012, 3232; Steinfeld et al. 2006, 131, 167–68). The remainder is used to water the animals and to process the dead ones (Deutsch, Lannerstad, and Ran 2011, 5).

The water use of the sector depends significantly on the production system. In extensive grazing systems, water use can be as low as zero liters per animal per day. However, in an industrial pig production system, for example, the water consumption is 125 liters per animal per day (Thornton et al. 2009, 117–18). This stark difference is broken down in the average caloric calculation that one megacalorie in form of cereals necessitates 500 liters of water on average, whereas one megacalorie in form of industrial meat necessitates 4,000 liters of water on average (Schneider 2014, 615). Mekonnen and Hoekstra (2011; 2012) have calculated the water footprint of crops and animal products displayed in table 3.

Table 3: Typical values for the volume of water required to produce common foodstuffs.[97]

Foodstuff	Quantity	Water consumption, liters
Cow meat	1 kg	15,415
Sheep meat	1 kg	10,412
Pig meat	1 kg	5,988
Butter	1 kg	5,553
Chicken meat	1 kg	4,325

97 Average values for 1996-2005.

Eggs	1 kg[98]	3,267
Cheese	1 kg	3,178
Rice	1 kg	2,497
Bread	1 kg	1,608
Milk	1 l[99]	1,020
Apples	1 kg	822
Potatoes	1 kg	287
Cabbage	1 kg	237
Tomatoes	1 kg	214

Note. Adapted from "Global Food: Waste Not, Want Not," by the Institution of Mechanical Engineers, 2013, p. 12, https://www.imeche.org/policy-and-press/reports/detail/global-food-waste-not-want-not. Copyright 2013 by the Institution of Mechanical Engineers. Reprinted with permission. Data from Mekonnen and Hoekstra (2011; 2012).

As shown, meat has an extremely high water footprint. Ruminant meat is the most water-intensive foodstuff, with 15,415 liters for a kilogram of cow meat. The production of one kilogram of pig meat needs 5,988 liters, and 4,325 liters are necessary for the same quantity of chicken meat. Eggs and dairy require less water than meat, yet much more water than cereals, fruit, and vegetables. One kilogram of rice requires 2,497 liters, and the same quantity of potatoes merely requires 287 liters. Tomatoes have an extremely low water footprint with 215 liters of water per kilogram.

The exceptionally large water footprint of the animal-industrial complex is not only an issue per se: withdrawing water also depletes the groundwater. Moreover, deforestation for crop land and pasture and changing land management practices, such as heightened grazing pressure, increase run-off formation (Deutsch, Lannerstad, and Ran 2011, 5). Last but not least, according to the FAO report *Livestock's Long Shadow: Environmental Issues and Options*, the complex is "perhaps the leading source" of water pollution in the Minority World (Steinfeld et al. 2006, 267): it contaminates rivers and streams with pesticides (United States: 37 percent of the pesticides applied), with heavy metals (England and Wales: 40 percent of copper applied), with antibiotics and other drug residues such as hormones, and coliform bacteria (Emel and Neo 2011, 72; Sneeringer 2009, 125; Steinfeld et al. 2006, 167–68).

2.3.7 Other boundaries

98 The calculation for one kilogram eggs is based on the assumption that one egg weights on average 60 grams.
99 One liter of milk weights on average 1.02 kilogram.

The three remaining boundaries are atmospheric aerosol loading, stratospheric ozone depletion, and the introduction of novel entities.[100] These boundaries are either not of particular significance for the animal-industrial complex, or lack relevant research. In addition, some boundaries, like the introduction of novel entities, have until date not yet been quantified, and the contribution of animal agriculture remains to be assessed.

Little can be said about the boundary of novel entities. Novel entities are defined as "new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects" (Steffen et al. 2015, 736). The animal industry releases or disposes of several noxious substances, like hydrogen sulfide and ammonia, airborne particular matter (inter alia, fecal matter and skin cells) and volatile organic compounds (Emel and Neo 2011, 71; Raworth 2012, 17). Such novel entities comprise radioactive and organic compounds, and heavy metals like mercury or lead. Pesticides and chemical pollutants, as endocrine disruptors, affect the behavior of small vertebrates and invertebrates—in other words, they modify life forms with unforeseeable consequences (Coghlan 2004).

2.4 Societal aspects

The ecological repercussions of the animal-industrial complex outlined above, including the devastating aftermaths of climate change, have a far-reaching influence on people's lives. Primarily, they affect the Majority World, what has prompted the concept of "environmental racism" (DeMello 2012b, 275). In the following, the focus is on the direct and indirect adverse effects of the exploitation of natural resources, the gigantic area and the colossal inputs like energy, water, and fertilizers the animal industry requires, and the violence it perpetuates. These effects include hunger and water-stress, colonization, climate injustice, brutal work conditions, and health issues.

2.4.1 Hunger and water-stress[101]

Metaphorically speaking, farmed animals are "reverse protein factories" (Lappé 2010): about 90 percent of calories are lost in the conversion of plant into animal matter (Godfray et al. 2010,

100 Atmospheric aerosol loading is a consequence of burning fossil fuels and biomass. Fine particles are released in the air and disturb global rainfall patterns; acid rain kills fish and degrades forests as well as crops; humans suffer from respiratory diseases (Raworth 2012, 17).

101 The European Environmental Agency (2016) defines water stress as occurring "when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use. Water stress causes deterioration of fresh water resources in terms of quantity (aquifer over-exploitation, dry rivers, etc.) and quality (eutrophication, organic matter pollution, saline intrusion, etc.)."

816; Machovina and Feeley 2014).[102] Section 2.1.4.1 ("Feeding capital") summarized that approximately 35 percent of global cereal production, more than half of the global maize and 85 percent of the global barley harvest, and the bulk of soybean production end up in feed troughs. In a conservative estimate, figure 5 in section 2.1.4.1 showed that cereal use for feed in the Majority World is expected to more than double by 2020 compared to 1992/94, from 194 to 409 million tons, and that by 2020, almost half of the global feed-grains (409 out of globally 928 million tons) are deployed in the Majority World.[103] With almost one billion people chronically suffering from starvation, and an additional billion mal-nourished (FAO 2016d; UNCTAD 2013, iii), this deployment of edible crops is sheer murder. In 2002, cereals (including rice) made up 55 to 70 percent of the diet of people in the Majority World (FAO Commodities and Trade Division 2002). The majority of people are themselves agricultural laborers or small farmers (UNCTAD 2013, iii), but counterintuitively, as elaborated in paragraph 2.1.1, many countries of the Majority World are net food importers.[104] Structural adjustment programs, trade liberalization, the reduction of subsidies for domestic production, and a switch from local staple crops to cash crops for the global market eroded local food security, not to speak of food sovereignty. Additional factors are protectionism and heavily subsidized exported goods from the Minority World (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 44–45; Jarosz 2009, 2077).[105] Jarosz reasons that

> "the food crisis is a predictable outcome of an oil-dependent feedgrain-livestock complex supplying a meat-centric diet for those who can buy it. This complex contributes substantially to climate change and is framed by neoliberal development policies, which deepen the commoditization of food, monetize food security and leave the world's people vulnerable to periodic food price spikes." (Jarosz 2009, 2065).

Already today, the world could theoretically be fed with current levels of cereal production (Holt Giménez and Shattuck 2011, 112).[106] Furthermore, approximately one third of all produced food is either lost or wasted (Small and O'Broin 2015, 173).[107] Hunger is thus not only a

102 Compare also the article "Redefining agricultural yields: from tonnes to people nourished per hectare" by Cassidy et al. (2013).

103 MacLachlan maintains that 36 percent of total cereal feed grains are cultivated in the Majority World (MacLachlan 2015, 31).

104 Out of the 79 so-called "Net Food Importing Developing Countries" (NFIDCs), some nations have to import about 30 percent of their cereal consumption (Fritz 2014, 8–9).

105 For more information on growing inequality worldwide refer to Jarosz 2012.

106 Remarkably, according to an Oxfam report, just one percent of the current global food supply suffices to cover the caloric needs of the thirteen percent of the world's population undergoing hunger (Raworth 2012, 5).

107 Food losses are products lost in the production process. Losses could be reduced by improving storage, harvest, processing, or distribution. Food waste means that products are wasted at the consumption stage. Whereas food losses mainly occur in the Majority World, food waste primordially takes place in the Minority World. In Sub-Saharan Africa, South and Southeast Asia, per capita consumer waste is six to eleven kilogram a year, while in Turtle Island and Europe, the average consumer wastes 95 to 115 kilograms a year. The food that is thrown away in the Minority World (220 million tons) is almost as much as the entire net food production of Sub-Saharan Africa (230

problem of production, but a much more complex problem of distribution: hunger is a political issue.[108]

To put matters into perspective, it helps to compare the use of grains for biofuels and for feed. If biofuels are objectionable, then animal feed equally is, insofar as it is the conversion of grains, a cheap and healthy food, into flesh, videlicet, a very expensive commodity for a societal elite. In 2009, 16 percent of global corn production was converted into biofuel (Locke et al. 2013, 52), whereas 60 percent ended up in feed troughs (FAO Commodities and Trade Division 2002). In the same year, less than one percent of global wheat production has been used for biofuels (Locke et al. 2013, 52), while 17 percent was fed to farmed animals (FAO Trade and Markets Division 2009). And the animal-industrial complex often paves the way (or, literally, clears the forest) for the production of biofuels.[109] In sum, it can be assumed that feed production for farmed animals is directly competing with food production for humans, and indirectly by degrading natural resources (Steinfeld 2004, 35)—and that this antagonism will sharpen in the future: Demand for feed grains and their prices are projected to rise. "As a result, progress in reducing malnutrition is projected to be slow," so the almost cynical observation of the International Livestock Research Institute expert Thornton (Thornton 2010, 2856).

What about water? Animal agriculture devours a third of global freshwater resources yearly (Mekonnen and Hoekstra 2012, 3232; Steinfeld et al. 2006, 131, 167–68). Agriculture in total consumes 70 percent, industries deploy 20 percent, and households consume only 10 percent of freshwater (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 28). As demonstrated in paragraph 2.3.6, the production of animal-derived food requires significantly more water resources than plant-based food (Pimentel and Pimentel 2003). On average, producing one megacalorie in form of cereals necessitates eight times more water than one megacalorie in form of industrial meat (Schneider 2014, 615). Future intensification of the complex will entail

million tons). Fruit, vegetables, roots and tuber have the highest share of lost and wasted food (namely 45 percent), 20 percent of beef is lost or wasted, which is equivalent to 75 million cows. Further, 20 percent of dairy products, 35 percent of fish, and 574 billion eggs are lost or wasted (Small and O'Broin 2015, 172–75).

108 Holt Giménez and Shattuck detect the related corporate food regime at the heart of the food crisis. They observe how, simultaneously with the advent of this food regime, the number of people suffering from hunger increased from 700 million in 1986 to 800 million in 1998 and spiked at one billion in times of the economic crisis (Holt Giménez and Shattuck 2011, 112).

109 Weis argues with regard to biofuels:

"In 2007, amidst rising food prices, the former UN Special Rapporteur on the Right to Food described the agrofuel boom as a 'crime against humanity'. That year, roughly 100 million tons of grain (mostly maize) were converted to ethanol, and modest amounts of soybeans and rapeseed were converted to biodiesel […]. The same year, almost 10 times as much coarse grain, soy, and rapeseed were used as feed, the products of which were consumed disproportionately in wealthy countries and by wealthier people within industrializing countries. Although this disparity between feed and fuel is closing fast, and it would be hard to overstate the economic, social, and environmental implications of the agrofuel boom on a world scale, at the same time it should not overshadow the need to also challenge the older, similarly regressive, and still bigger flows of grains and oilseeds through industrial livestock." (Weis 2013b, 80).

an additional drain on water resources (Thornton 2010, 2861). At the same time, 2.4 billion people, a third of the world population, do not dispose of a sufficient amount of freshwater (Thornton et al. 2009, 117). Out of those 2.4 billion people, 1.1 billion people have no access to clean drinking water at all. By 2025, this figure will rise to 1.8 billion people (FAO Water 2013), and almost half of humanity will be concerned by water stress (UNEP 2016).

2.4.2 Colonization and meat grabbing

From its very origins, the animal-industrial complex, now covering 45 percent of global land surface, is entangled with colonialism (Nibert 2013). Indigenous communities have been and are being expropriated or violently displaced for grazing and crop land (Nibert 2011, 204; 2012b, 279). The Spanish colonizers introduced ranched animals in Latin America, and with them, zoonosis, which killed millions of indigenous people. In the nineteenth, twentieth, and twenty-first centuries, Native Americans were and are displaced and annihilated for the expansion of ranching operations (Nibert 2011, 197–99).[110] As Schneider illustrates with the "meat grab," the local population is dispossessed of their land not only at the initial land deal, but also later on through all the externalities of animal production, like air, land, and water pollution (Schneider 2014, 626). It is not that plans for building factory farms or clearing of forests to grow feed would not encounter resistance (Emel and Neo 2011, 75). However, the battle of indigenous groups or peasant movements is and has often been silenced by powerful opponents (Winders and Nibert 2004). In South America, outright armed conflicts have erupted due to the livestock industry (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 33).[111]

2.4.3 Climate injustice

110 In the history of the United States specifically, the colonization of vast regions was coupled with animal farming. The Euro-settlers introduced domesticated cows, pigs, chickens, and other farmed animals (Powell 2014b, 19). Livestock agriculture occupied (and still occupies) the land of the indigenous inhabitants and destroyed their traditional agricultural practices. In the words of environmental sociologist Powell, "this system […] steals land from people in order to enact violence on other animals" (Powell 2014a, 30–31). Today, the minimal amount of reservation land granted to First Nations in the United States sums up to 22 million hectares, compared to 248 million hectares used for grazing farmed animals. In this figure, the land used to grow animal feed is not included. In Canada, three million hectares are designated to reservation land compared to 20 million hectares grazing land (Powell 2014a, 30–31). Belcourt, an indigenous decolonial critical animal studies scholar, portrays "settler colonialism and white supremacy as political mechanisms that require the simultaneous exploitation or destruction of animal and Indigenous bodies" (Belcourt 2015, 3). Advancing a decolonial politics of space, he portrays factory farms as "violent colonial geographies wherein the animal body is subject to surveillance and death to produce capital/commodity products and sustain carnivorous food cultures" (Belcourt 2015, 4). "[D]omesticated animal bodies," according to Belcourt, have to be re-theorized "as *colonial subjects* that must be centered in decolonial thought." (Belcourt 2015, 3 [original emphasis]). The situation on Turtle Island might be a specific one, still, it remains emblematic for the ongoing violent and (neo-)colonial expansion of the animal-industrial complex.

111 In return for the military's initiative to expropriate land owners in Latin America for ranching and grain fields, according to Nibert (2011), the animal industry provides the military with subsidized animal foods and live animals for military operations. For Nibert, this is one illustration of the entrenchment of the military-industrial complex and the animal-industrial complex. Among his other examples are the invasions of the Roman Empire that built on the exploitation of horses, mules, and cows as food resources, or the recreational hunting industry as an exercise in both weapons training and killing, as well as dominion over nonhuman animals, all by generating considerable profits for the armaments industry (Nibert 2014, x).

As elaborated in paragraph 2.3.1, animal agriculture contributes more to global warming than the transport sector. In international climate negotiation, it has become clear that global warming will not be halted at two degrees Celsius by the end of the century. A rise in the mean temperature of four to six degrees Celsius—not improbable for the two scenarios RCP 6.0 and RCP 8.5 (IPCC 2014b, 11–12)—would engender an immense erosion of agricultural output, and mass hunger and starvation (Sethness-Castro 2012, 14–15).[112] The International Organization for Migration estimates that by 2050, there will be about 200 million "climate refugees," or "environmental migrants." This amount equals the current approximation of international migrants worldwide (IOM 2014).[113] DARA international, a non-profit organization evaluating disaster risk reduction, predicts that between 2010 and 2020, five million people die of the repercussions of climate change, and almost all of these deaths are supposed to occur in the Majority World (Sethness-Castro 2012, 25).

For indigenous people, climate injustice is a continuation of colonialism; a so-called colonial *déjà vu* (Whyte 2017). Settler-colonialism has manifested itself in containing and ultimately erasing indigenous lives, through the physical confinement and the destruction of their political and cultural systems. Global warming and concomitant rapid environmental change can be viewed as just another manifestation of containment. Indigenous people experience threats to food security, water scarcity, relocation from historic homeland, as briefly mentioned in paragraph 2.3.1, arctic sea ice loss, and permafrost thaw (Whyte 2017, 6). It follows that "[c]olonialism, such as U.S. settler colonialism, can be understood as a system of domination that concerns how one society inflicts burdensome anthropogenic environmental change on another society" (Whyte 2017, 4).

2.4.4 Brutal work

Not only the socio-ecological impact, but also the working conditions in the animal-industrial complex are drastic. [114] The work itself is high-speed and risky (Boggs 2011, 73), the temperatures are extreme, and the atmosphere is "noisy with the cries and reeking with the stench of anguished animals," according to Weis (2010, 147). It follows that the animal-industrial complex

112 Climatologist Anderson controversially judges that only ten percent of humanity, around half a billion people, would survive such a warming (Sethness-Castro 2012, 14–15).

113 Nonetheless, it can be noted that the UN-discourse on "climate refugees" tends to naturalize and depoliticize climate change (Methmann and Oels 2015).

114 For reasons of scope, the situation of workers in the fishing industry cannot be portrayed in detail. In a short assessment, it appears that human rights violations are repeatedly documented. Overfishing and depleted fish stocks lead to longer periods at sea, going further afield, and even more destructive fishing methods. To keep costs low, fishing fleets exploit trafficked workers (EJF 2015, 4). Overfishing of their own local sea and the deprivation of their livelihoods can lead fishing communities to be recruited into criminal activities or slave labor. The slave workers on fishing vessels endure incredible hardship, and they face physical and sexual violence, torture, and murder (UNODC 2011).

is one of the most dangerous industries in terms of occupational physical injuries (Winders and Nibert 2004, 89).

The toil is precarious and offers minimal pay, organization in labor units is almost non-existent (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 14; Nibert 2011, 205).[115] Generally, organization of the workers is rendered impossible through language barriers. Slaughterhouses are organized along racial and class lines. The workers are frequently migrants with short-term contracts by work agencies (Hamilton and McCabe 2016, 333). Moreover, the compartmentalized work in abattoirs inhibits the employees from gathering and working together (McCabe and Hamilton 2015, 96), with some facilities being fully or almost-fully automated (Emel and Neo 2011, 79). What is more, sexual harassment is widespread in slaughterhouses, particularly targeting women* of color (Nibert 2011, 205). On top of that, the employees enjoy no social recognition: their work is considered "dirty" and hidden from public view (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 14). It is thus not surprising that in some slaughterhouses, employee turnover is almost a hundred percent per annum (Emel and Neo 2011, 74).

Most troublingly, workers in the animal-industrial complex suffer disproportionately from psychological trauma (McCabe and Hamilton 2015; Torres 2007, 45).[116] The sheer number of animals and the fast pace with which they have to be handled or processed provoke an emotional distancing among the workers (Jacques 2015, 595; Taylor, Richards, and Signal 2013, 396). The traumatic work is associated with negative coping strategies like substance abuse (Baran, Rogelberg, and Clausen 2016).[117] Similarly, it heightens the propensity for violence against the farmed animals which functions as a form of "catharsis," as reported by respondents (Porcher 2011, quoted in Taylor, Richards, and Signal 2013, 396). In a quite disturbing study on the well-being of slaughterers at a South African commercial abattoir, the researchers observed numerous accounts of sadness, shame, fear, anger, and trauma, resulting in recurring nightmares, shivering, and stress among the workers (Victor and Barnard 2016). The investigation explained that, after the initial adjustment phase at the facility, the workers developed an emotional detachment from their daily tasks. They experienced short temper, elevated aggression, and a lower frustration tolerance that prompt violence directed towards women,* children, and pets. As one slaughterer maintains:

115 In the United States, corporations purposefully inhibit unionization efforts through the relocation of slaughterhouses to regions where workers' rights are minimal (Nibert 2011, 205; Winders and Nibert 2004, 89).

116 For an impressive ethnography on slaughterhouse work, see Pachirat 2011.

117 Workers in U.S.-slaughterhouses reportedly take drugs like speed or amphetamines to comply with the pace of conveyor belts (Torres 2007, 45).

> "I can kick it if I want to because I kill cattle every day. Kick this dog or cat so that it flies just because you can, you don't worry see it feels like I must hurt this other animal." (Victor and Barnard 2016, no page numbers).

Emotional suppression of the violence they inflict and witness includes a feeling of invincibility, as well. A second slaughterer boasts:

> "I am not afraid anymore. I'm killing thousands of cattle. You won't tell me, I'm not scared of blood; I'm not afraid to slap you with my knife" (Victor and Barnard 2016, no page numbers).

The extreme acts of violence inflicted or observed every day at the slaughterhouse trigger domestic abuse (Eisnitz 2007). A study by Fitzgerald et al. indicates that "slaughterhouse employment increases total arrest rates, arrests for violent crimes, arrests for rape, and arrests for other sex offenses in comparison with other industries" (Fitzgerald, Kalof, and Dietz 2009, 158). Not only the occupation, but also the mere presence of a slaughterhouse in a region significantly heightens the number of total arrests, arrests for offenses against the family, and arrests for rape. This "spillover" of violence has been termed the "Sinclair effect," referring to Sinclair's 1906 novel *The Jungle* (compare footnote 18). In industries employing an equally high number of young (solo) males and precarized immigrants, like in horticulture, there is no similar effect on crime in the region (Jacques 2015). In mainstream media, and, too often, equally in the animal protection movement, the violence these workers perpetuate is not comprehended as a structural problem resulting from social inequality and their brutal and dreadful work, produced and reproduced by the animal-industrial complex (compare also section 2.2 on animals and violence) but as an individual act of malevolent abuse.[118]

2.4.5 Health issues

Health issues and animal agriculture are entangled in a wide array of ways.[119] They stretch from the production of feed to the production of animals to the consumption of their body parts (Gunderson 2012).

2.4.5.1 Feed production

118 Political scientist Pachirat has studied the exposure of five Black and Latino workers at a turkey slaughterhouse run by the U.S. corporation Butterball. In an undercover investigation by an animal welfare organization in 2012, these men were filmed committing animal abuse and charged in the aftermath. The CEOs of Butterball joined the public outrage and were quick in condemning the acts and demonizing the employees, but were never held responsible (Pachirat 02.03.2015). The Huffington Post, among others, reported on the incident (The Huffington Post, February 16, 2012).

119 Compare two recent publications on the issue of health and sustainability: Raphaely and Marinova 2016 and Tilman and M. Clark 2014.

The use of fertilizers and pesticides in feed production has multiple health effects. Nitrogen oxide in the air is associated with cough, asthma, and other respiratory diseases. Nitrate in the groundwater can cause reproductive problems. Pesticides contaminate water and food and can cause poisoning, various cancers, and nervous system damage (Gunderson 2012, 55). In many countries of the Majority World, pesticides that are known to be carcinogenic are still applied to crop fields (O'Laughlin 2016, 32).[120] The prevalence of such harmful substances in agriculture is again a marker of inequality.

2.4.5.2 Animal production

Residents near CAFOs are directly affected by air and water pollution. Industrial livestock operations favor the development of multi-drug-resistant bacteria in natural waters (West et al. 2011, 473), for instance the antibiotic resistant bacterial pathogen *Staphylococcus aureus*. Q fever, a fewer caused by *Coxiella burnetii*, bacteria mainly found in sheep, goats, and cattle and transmitted through manure, is positively associated with residing near an animal factory (Casey et al. 2015). Coliform bacteria and nitrate from liquid manure provoke human health problems such as gastroenteritis outbreaks (Sneeringer 2009, 126). In the complex, heavy metals like copper, zinc, or iron are used as growth promoters, yet they are not fully absorbed by farmed animals and end up in drinking and recreational water (FAO 2005, 7; Gunderson 2012, 55). Air pollution, mainly through ammonia and hydrogen sulfide, results in respiratory illness, perinatal disorders, high infant mortality, and even spontaneous abortion (Emel and Neo 2011, 71; Rule et al. 2005, 9649; West et al. 2011, 473). CAFOs emit hazardous gases and dispose of toxic animal waste, and there is danger of asphyxiation near sewage lagoons (Cassuto and Saville 2012, 192). Feelings of stress and anxiety are positively associated with residing near an animal factory, too (Casey et al. 2015; Gunderson 2012). As an interviewee of western Romania, home of Smithfield's 40 new hog farms, put it, "We go crazy with the daily smell" (Carvajal and Castle, May 05, 2009).

It is not surprising that CAFOs are located in low-income regions where communities do not have a say in the economic development of their region. "[P]igs, poultry or prisons" oftentimes represent the sole economic choices of rural areas in the United States (Emel and Neo 2011,

120 In Argentina, the world's biggest soy exporter, the use of herbicides has increased eleven-fold in some regions since 1990. Local rural populations and peasants are suffering from miscarriages and birth defects. Cancer rates in these regions are over ten percent higher than the national average of 19 percent (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 33).

75).[121] In the United States, CAFOs are built in regions mainly inhabited by Blacks, Latin@s, or Asian Americans (DeMello 2012b, 275; Lenhardt and Ogneva-Himmelberger 2015).

Farmers and workers inside the factories are exposed to a number of hazardous elements, among them pesticides, dust, solvents, and infectious microorganisms. Respiratory diseases from organic dust are prevalent among staff, which often spends more than 40 hours weekly in the facilities (Kirkhorn 2001). These respiratory conditions include mucous membrane inflammation syndrome and bronchitis—70 percent of CAFO employees suffer from the latter (Kirkhorn 2001, quoted in Cassuto and Saville 2012, 192).

Animal production and zoonosis threaten public health. Emerging new zoonoses[122] like the H1N1 influenza virus ("Avian flu"), BSE,[123] and the *Nipah* virus have triggered major global health crisis (Steinfeld 2004, 36–37). Animals are the origin of 70 percent of all new human illnesses. The majority of these diseases comes from wildlife and is transmitted by livestock (Global Agenda for Sustainable Livestock 2014b, 3).

2.4.5.3 Consumption

The unequal geography of meat corresponds to an unequal geography of health.[124] As Gunderson (2012, 54) articulates referring to Walker et al. (2005):

121 A historic parallel between the animal- and prison-industrial complex is the formation of rural "cattle towns" in the United States during the nineteenth century, and the "prison towns" of the twentieth and twenty-first centuries. Both complexes witnessed a sharp increase in inmates in the 1970s and 1980s, due to intensified agriculture on the one hand, and new drug laws and subsequent mass incarceration on the other. The location, aesthetics, architecture, and silence of slaughterhouses and prisons are equally similar (Morin 2016), and both are environmentally polluting (Panagioti/Earth First! Newswire 2015). Moreover, both the animal-industrial and the prison-industrial complex deprive individuals of their freedom. In an inspiring essay on the "carceral space" shared by both human prisoners and nonhuman animals, Morin (2016) draws parallels between the structural, psychological, emotional, and spatial similarities experienced by human and nonhuman inmates. The U.S. anarchist Rayson calls prisons "the kiss of death to a community. They bully the whole country […] with an unhealthy, deliberately ruinous, wasteful, oblivious, and punishing mindset. They also pollute pitilessly and 'legally' cut local deals so they can maraud over all areas, economically and culturally. I'm talking about all the industries, factories, prisons, animal farms, military centres—all of it." (Rayson 2006, 248). In addition, human prisoners have to engage in direct forms of animal exploitation, whether butchering animals or being forced to work on farms. Concurrently, nonhuman animals are used as therapeutic objects to "re-socialize" inmates (Twine 2012, 16–19). And as mentioned before, the state heavily criminalizes animal rights activists. Yet, not only do human prisoners have to (violently) deal with animals in prison, they are also compared to violent animals. They are de-humanized and portrayed as "subhuman." Such animalization is a societal instrument that produces and reproduces domination and ultimately renders prisoners—like nonhuman animals—"disposable" (Morin 2016; Twine 2012, 16–19).

122 Traditional zoonosis are, among others, *brucellosis* or *trichinellosis* (Costales, Gerber, and Steinfeld 2006, 23).

123 BSE affects humans as Creutzfeld-Jakob disease (Steinfeld 2004, 36–37).

124 In the United States, "[h]ealth disparities between Black and white Americans are one of the worst legacies of slavery and colonialism," according to the social scientist Harper. She points to obesity, heart disease, and diabetes, and encourages the Black population to dismiss products that impair their health (Harper 2010c, 29). The rejection should be a means to decolonize their bodies from the animal-industrial complex and the health/environmental racism it causes (Harper 2010a).

> "one billion people are overweight or obese largely due to increased meat consumption (as animal products are the primary source of saturated fats) while one billion people are malnourished due to reduced crop availability to sustain increased meat consumption for the wealthy."

The animal-industrial complex generates thus both obesity and hunger. Both physical states can be a sign of poverty. So-called "food deserts" prevail in economically poor areas. In food deserts, healthy food like fruit and vegetables are scarce and expensive, whereas high-fat, processed food is widespread and cheap (Jarosz 2009, 2075). In fact, obesity kills three times more individuals than hunger and has been defined as "the world's number one health problem" (Global Agenda for Sustainable Livestock 2014b, 2). What is more, an elevated consumption of animal foods has been linked not only to obesity (Rivera-Ferre 2009, 96) but also to diseases of affluence such as high blood pressure, diabetes, cardiovascular diseases, and certain forms of cancer (Herrero et al. 2009, 112; Nibert 2011, 207). In countries where meat consumption is increasing, the prevalence of these illnesses rises as well (Walker et al. 2005). Finally, consumers of animal products are additionally affected by the use of hormones and antibiotics in the industry (compare paragraph 2.1.4.2) (Jarosz 2009, 2075; Steinfeld et al. 2006, 140–42)—around 80 percent of antibiotics in the United States is administered to livestock—and by the contamination of animal foods.[125]

125 Product contamination is caused by inappropriate hygiene in the production process. Salmonella or E. coli bacteria, for instance, are microbes that reside in the intestinal tract of livestock (Steinfeld 2004, 37).

PART II

3 DEALING WITH DISTRACTIONS: GREEN CAPITALISM[126]

"There is only one thing bigger than Mother Nature and that is Father Profit"
(Friedman 2008, 244, quoted in Kenis and Lievens 2015, 70).

After the overview of the animal-industrial complex, this chapter outlines the theoretical perspective of the thesis. Animal production is predicted to double by 2050. Production must be intensified, but the environmental consequences must be curbed, as well. This is the Livestock Revolution narrative. How can this extraordinary equation be effected? The response is "sustainable intensification." Yet what does "sustainable" mean? This chapter starts with this question then moves on to delineate the evolution of sustainable development discourse. First, it traces the transformation of this discourse into green capitalism. Green capitalism, in turn, is generally understood as implementing environmental measures and technologies in corporate policies, in other words, "green" economic growth. Yet, this chapter introduces a theoretical model or, rather, *move* with which the societal character of the oxymoron green capitalism can be grasped more thoroughly. On the one hand, green capitalism is understood as a move toward the naturalization of control and capitalism, with control here meaning societal regulation and ordering mechanisms. On the other hand, green capitalism is a program meant to control and capitalize on nature. In a nutshell, it proposes a double effect or *mirror move* of naturalization and capitalization.[127] The mirror move transforms debatable social questions into either indisputable biological facts, or apparently apolitical issues of technology or governance. This trick serves as a potent distraction from political conflicts, power structures, and the dangers of the ongoing environmental crisis itself.

3.1 From sustainable development to green economy

The evolution of the concept of sustainable development has been extensively studied and criticized,[128] and its definitions heavily debated. The vagueness of the term indeed allows for problematic interpretations (Luke 2006, 99). For some scholars, sustainable development has be-

126 Such was the title of an activist-academic zine on the climate summit in Copenhagen in 2009 (Passadakis et al. 2009).

127 Ecofeminist theorist Wichterich observes a similar trend and speaks of an "ecologization of the economy and an economization of nature" (Wichterich 2015, 72).

128 Compare Jamieson 1998; Robinson 2004; Sneddon, Howarth, and Norgaard 2006.

come a "buzzword" (Lélé 1991; Rist 2014), a "floating signifier" (Laclau, see Tregidga, Milne, and Kearins 2011), or even the new "governmentality" (Luke 2005). In point of fact, companies, media, the state and other actors use—and perhaps abuse—the concept as they like. There are sustainable cars, sustainable economies, and even sustainable beef by McDonald's (McDonald's 2017). One crucial document in the sustainable development discourse is the Brundtland Report (WCED 1987); nearly every concept of sustainable development created after 1987 is in one way or another based on the Brundtland-definition of sustainable development. This report identified poverty and "underdevelopment" as reasons for the environmental crisis and hence proposed economic growth as the go-to solution for poverty eradication and the crisis.[129] Poverty was portrayed as a naturally occurring, apolitical phenomenon; its counterpart, wealth, was not further problematized (Rist 2014). Ideologically, the report aligned sustainable development with neoliberal capitalism and its limitless growth (Peet, Robbins, and Watts 2011, 7).

This stands in stark contradiction to the 1972 *Limits to Growth* publication by the Club of Rome (Meadows et al. 1972), although the report has been marked by a deep Malthusianism and systems ecology (Peet, Robbins, and Watts 2011, 2; Weis 2010, 131), and to the radical environmentalism of the 1970s. Banerjee observes a corresponding discursive shift from the early, rather intimidating environmental sustainability demanding radical systemic change, [130] to a pleasant sounding, corporate sustainability that can be promoted, precisely measured, and, ultimately, achieved (Banerjee 2003, 163). The relegation of the ecological dimension of sustainable development and the spotlight on its economic dimension has reduced sustainable development to rational environmental management (Luke 2005, 232). Therefore, Luke equals sustainable development to "sustainable degradation." Sustainable development policies do not halt degradation; degradation is simply "measured, monitored, manipulated within certain tolerances" (Luke 2006, 99). For the animal-industrial complex and the Livestock Revolution, this thesis proposes the term "sustainable exploitation."

Nowadays, numerous sustainable development theories and policies focus on the marketization of natural resources, on efficiency gains, recycling and on the strategy of "decoupling" of human activities from natural cycles (UNEP 2011).[131] These policies suggest that the limits to

129 For a critique on the sole focus on poverty, see Satterthwaite 2003.

130 A definition of sustainable development grounded in ecology has been proposed by ecological economist Daly: "Limit use of all resources to rates that ultimately result in levels of waste that can be absorbed by the ecosystem. Exploit renewable resources at rates that do not exceed the ability of the ecosystem to regenerate the resources. Deplete nonrenewable resources at rates that, as far as possible, do not exceed the rate of development of renewable substitutes." (Daly 2007, 34).

131 Such theories are classified as so-called "weak sustainability" approaches. Weak sustainability encompasses the idea of the possibility of replacing "natural capital" through other forms of capital and relies on neoclassical environmental economics; whereas in its contrasting approach, so called "strong sustainability," it is assumed that

growth can be "expanded" through technological innovation, and, finally, that it is chiefly profitability that must be sustained. Likewise, it is contended that sustainable development has been transformed into green economy, or, more comprehensively, green capitalism (Kenis and Lievens 2015).

3.2 Naturalizing control and capitalism

The first move of naturalizing societal control and capitalism is to establish a strategy that legitimizes a certain societal order. This strategy is the ontologization and biologization of hierarchy and power relationships. In our case of naturalization in green capitalism, biological models, "natural laws," are directly applied onto human society, and vice versa (Biehl and Staudenmaier 2011, 19–20). The social is "ecologized" (Hajer 2000, 264). The seemingly "neutral" and "scientific" character of such ecological notions naturalizes and legitimizes abovementioned power structures in human society (Franklin 2011). Otherwise contingent and highly political situations of inequality are de-politicized which excludes a questioning of these "facts" and a subsequent struggle for alternatives. It is forgotten that those exact same biological categories are, first and foremost, social ones. The biological and ecological disciplines have not evolved isolated from society, as separate entities; they are continuously shaped by and adjusted to societal vicissitudes and norms. Accordingly, the relationship ecology/society goes both ways and is a rather dialectical one. This chapter first portrays the imperial and racist roots of the ecological discipline then elucidates examples of biological models used for society.[132] Next, it introduces modernization theory, which imagines human societies as biological, plant-like organisms developing on a linear basis and culminating in the "modern" Euro-colonizer or Minority World civilization. It then sketches the relationship between modernity and coloniality, as well as how sustainable development conveys imperial notions. Finally, the environmental degradation of alleged human overpopulation is compared to the one caused by the "imperial mode of living."

3.2.1 The racist and imperial origins of ecology

A glance at the history of ecology illustrates the intertwinement of the social and the study of nature. Quite fundamentally, the history and concept of ecology itself is entangled with (European) fascism and imperialism.[133] In the late nineteenth century, a specific synthesis of romanticism, environmentalism, and nationalism blossomed in Germany.[134] This ideology venerated the

some parts of "natural capital" cannot be substituted through other capital. An approach where one assumes that nothing of "natural capital" can be substituted through something else would be called "very strong sustainability" (Beckerman 1995; Daly 1995; Robinson 2004).

132 Imperialism is here defined as "theories and practices developed by a dominant metropolitan center to rule distant territories, by force, by political means or by economic, social, and cultural dependence." Most often a result of imperialism, colonialism "involves the establishment of settlements on outlying territories." (Banerjee 2003, 146).

133 For a more detailed account of the history of the ecological discipline, see McIntosh 1985.

134 Today, environmentalism still merges with nationalist politics in Germany. Ecology has been a main proponent of the Far Right wing and of National-Socialism in Germany throughout the twentieth century with its emphasis on

land, peasantry, and "racial purity," and despised the urbanization and industrialization that caused "the decline of the race" (Biehl and Staudenmaier 2011, 15–18). The founder of modern ecology, German zoologist Ernst Haeckel (1834-1919), was part of this movement that was influential for the rise of German national-socialism in the twentieth century.[135] Haeckel stated that "civilization and the life of nations are governed by the same laws as prevail throughout nature and organic life" (Haeckel 1876a, 11, quoted in Biehl and Staudenmaier 2011, 19). Early ecology should illustrate the familiarity between civilization and nature: The spelling of the word "ecology" itself was, after extendedly debating the versions *œcology*, *æecology*, or *öcologie* aligned to the spelling of "economy," hereby underlining the "correlation between nature's and society's economy" (Anker 2001, 1).

The unholy alliance of nature conservation and racism took place in the United States, as well, where the creation of national parks was intrinsically linked to the destruction of Native lands for the "conservation of the Great Nordic race"—a conservation which was not a "matter […] of racial pride," but "of love of country", as Henry Fairfield Osborn, head of the New York Zoological Society and the board of trustees of the American Museum of Natural History, wrote. Wildlife conservation went hand in hand with eugenics; the nobility of nature and the "human race" were to be protected against the reproduction of the "paupers," the physically "unhealthy," or "Mediterranean" populations.[136] U.S. romantic naturalist John Muir and U.S. author Henry David Thoreau both understood "American greatness" as a *white* nation, they both imagined white farmers as "symbolically native" and blissful to the land.[137] Some four-legged "animal people"—megafauna—were to be preserved, while the actual Native Americans, the "dirty Indians," were to be driven out and extinguished (Purdy 2015).[138] In essence, nature in the United States is raced: it has "turned white" in the twentieth century, with the eradication of the First Nations, but "was very dark before that" (Kim 2015, 153–54).[139]

"blood and soil" (Olsen 2000).

135 Haeckel developed "monism," a principle based on evolutionary theory, ecological holism, and *völkisch* ideology (Biehl and Staudenmaier 2011, 18).

136 Such pseudo-scientific arguments were advanced by Madison Grant, an early environmentalist and white supremacist, in his book *The Passing of the Great Race, or The Racial Basis of European History* (Grant 1916), for which he was congratulated by Theodor Roosevelt, a proponent of land conservation, and Adolf Hitler (Purdy 2015).

137 In the nineteenth century, the land, nature, and wilderness were additionally regarded as healthy places where (heterosexual) masculinity could be perfected—in contradistinction to an intoxicated, polluted, and fast-paced urban environment that created crime, decadence, and homosexuality (Mortimer-Sandilands and Erickson 2010, 13–15).

138 Haeckel claimed: "Now, the mental differences between the lowest men and the animals are less than those between the lowest and the highest men" (Haeckel 1876b, 366). Hitler echoed this statement some decades later (Purdy 2015).

139 Political scientist Kim defines race as "a means of producing and disciplining different and inferior bodies" (Kim 2015, 15) and thereby builds on Omi and Winant's *Racial Formation in the United States* (Omi and Winant 1994). Sociologist of race Winant illustrates the contingency of race as a social category:
"At its most basic level, race can be defined as a *concept that signifies and symbolizes sociopolitical conflicts and interests in reference to different types of human bodies*. Although the concept of race appeals to biologically based

In the British colonies, ecology was one strategy and scientific legitimation used to order and control "material and human resources" (Anker 2001, 2–3). Ecology thus has a distinctively imperial tradition (Anker 2005, 240).[140] In the beginning of the twentieth century, the development of purebred animal breeding went hand in hand with political racism (Da Cal 1992) and the ideology of "racial" and "class hygiene." Class hygiene meant that the lower classes should be discouraged to reproduce (Skabelund 2008, 356). This—albeit less apparently racist—misanthropy continues today in postulations of the problem of "overpopulation" (resonating with Ehrlich, author of *The Population Bomb* of 1968). Whereas in the first half of the century, the prevalent "solution" was (forced) sterilization of the poor, the contemporary method is (forced) population planning (Purdy 2015; Weis 2010, 132).

The connection between ecology and oppression is continued in current examples of environmental racism. Environmental racism refers to the condition that groups who are discriminated against because of their race disproportionately suffer from environmental hazards, be it landfills, mines, pollution through resource extraction or factories, or the general consequences of climate change and environmental degradation (Pellow 2016, 2). Environmental racism in the animal-industrial complex has been exemplified in chapter two.

3.2.2 Natural and social systems

In the war-torn world of the first half of the twentieth century, ecology, a scientific mode of ordering nature and society gained popularity (Anker 2002, 612). A specifically successful concept was the ecosystem.[141] Ecosystem theory is a specific framing of nature as stable and that, if disrupted, it eventually returns to a certain kind of equilibrium. Whereas the concept of ecosystem theory originated in the nineteenth century, it only gained popularity in the 1960s with the rise of systems analysis and computer science (Montague 2015; Müller 1997, 141). In the words of ecologist O'Neill, "Systems Analysis dealt with complex systems as interconnected components with feedback loops […] that stabilized the system at a relatively constant equilibrium point." (O'Neill 2001, 3275–76). The application of systems analysis to ecology (and therefore its evolution from a "soft" to a "hard" science) resulted in systems *ecology*. Systems ecology

human characteristics (phenotypes), selection of these particular human features for purposes of racial signification is always and necessarily a social and historical process. There is no biological basis for distinguishing human groups along the lines of race, and the sociohistorical categories employed to differentiate among these groups reveal themselves, upon serious examination, to be imprecise if not completely arbitrary" (Winant 2000, 172 [original emphasis]).

140 Compare Anker's work *Imperial Ecology: Environmental Order in the British Empire, 1895-1945* (2001), and Ax et al.'s *Cultivating the colonies: Colonial states and their environmental legacies* (2011).

141 An ecosystem is defined as *"a unit comprising a community (or communities) of organisms and their physical and chemical environment, at any scale, desirable specified, in which there are continuous fluxes of matter and energy in an interactive open system."* (Willis 1997, 270 [original emphasis]).

compared nature to a machine. This helped to deal with the complexity of nature: to reduce complexity, some factors were being ignored or de-emphasized using computer modeling, simulations, and applied mathematics (Willis 1997, 269). Furthermore, as the public understood what a machine was about, the application of systems analysis helped to explain natural phenomena (O'Neill 2001, 3275–76). Concretely, the central goals of systems ecology were (and are) the prediction of ecological change and emergent properties, predicting responses to disturbance, and testing theories of ecosystem (self-) organization (Montague 2015).[142]

After several decades using the hypothesis, ecosystem theory has progressively become criticized within ecology and has been called a "myth" (O'Neill 2001) or a "fantasy" (Curtis, June 09, 2011).[143] From the social sciences, the ecosystem concept has, not surprisingly, faced criticism as well. Why? Systems analysis, the computer science and therefore innately human enterprise, was not only applied to ecology. It was equally used to understand human society as a natural system. Two of the founding principles of ecosystem theory were cybernetics and hierarchy theory. Society turned into an ecosystem: a hierarchically structured, self-regulated entity with a natural order and equilibrium.[144] After the Second World War, cybernetics forecasted societal upheavals and pre-calculated such "feedbacks" in order to better answer and pacify uprisings (Müller 1997, 142–43). Once the societal order was disturbed, so the theory, it had to be re-established and brought back to equilibrium by countering the shocks.

142 One origin of applied ecosystem research in the United States was military research to produce "self-sufficient closed ecological systems" for bunkers, submarines, and spaceships. In a loop, the findings from this "cabin ecology" were applied to "Spaceship Earth" (Anker 2005, 239–40). Cabin ecology was for example used in the adventurous creation of "Biosphere 2" in Arizona of 1991 (Anker 2005, 240; Curtis, June 09, 2011).

143 Two ecological criticisms of ecosystem theory are that it assumes, first, spatial closure, and second, balance. First, an "ecological whole" is empirically difficult to define, and ecological situations are constantly changing. It is hence unclear where an ecosystem begins and ends, in space and time. Second, there is no consensus about the purported "balance" of ecosystems because there is a lack of any precise quantitative yardstick. Claims about balance are always imprecise: Shrader-Frechette declares that "there may be some sort of stability or balance for a given species within a certain spatial scale, but not for other species, or not within another such scale," moreover, "there is no universal level (across species, populations, or communities) at which some balanced or stable whole exists" (Shrader-Frechette 2001, 308–9). In fact, if ecosystems are analyzed by a species list, the ecosystem with the shortest—impoverished—list will be the most "stable." The notion of stability, hence, becomes blurred; over time, every ecosystem will get unstable. The analysis thus depends on the scale of time and space (O'Neill 2001, 3277). Consequently, recent research in ecology has abandoned the model of balance and equilibrium in favor of a more dynamic approach to nature, studying change, shifts, and complexity (Botkin 1990; Lidström et al. 2016, 25). In general, the scientific discipline of ecology, studying living beings and their relationships with the environment, is, due to its broadness and all-encompassing nature, imprecise and not predictive (Shrader-Frechette 2001, 304). Historian of science Kingsland defines ecology as 'the study of patterns in nature, of how those patterns came to be, how they change in space and time, why some are more fragile than others' (Kingsland 1995, 1)" (Shrader-Frechette 2001, 304). Ecological problems are very complex; they are constantly evolving and involve uncertainty and numerous parameters. Basic ecological terms like "species" or "community" are necessarily vague. Every ecological situation, every biological element is unique (Besek and McGee 2014, 77; Shrader-Frechette 2001, 310–11).

144 As a matter of course, competing paradigms to grasp "nature" have existed throughout space and time. For instance, sociologist Franklin describes how the notion of an ordered, stable "ecosystem" stands in opposition to Aboriginal perspectives on land and nature. Aborigines use the notion of "landscape" whose shape, species, and number of inhabitants are in constant change, thus lacking a normative perspective of how a landscape is supposed to look like or be composed of (Franklin 2011, 213–14; Warren 2007, 434).

One corresponding case in point of systems ecology discourse in society is resilience theory and "resilient populations" in face of climate change.[145] International Livestock Research Institute expert Thornton writes for instance that actions are needed that "increase or restore resilience where this is threatened" (Thornton et al. 2009, 114). However, models like "resilient populations" transport the image that catastrophes like droughts or inundations are simply "natural shocks," and that order will be re-established. The responsibility looks neutral, and the effect as well. Concepts like resilience thus hide societal struggles, ever-changing power dynamics, and inequality (Hornborg 2009, 252).

A final example of systems ecology and the entanglements of society and ecology are "invasive species." Its fixation on pristine nature, purity, and nationalism bears a striking resemblance with the brown origins of ecology. Invasive species are generally defined as "nonnative species that have detrimental effects on ecosystems and/or economies" (Tuminello 2013, 502). The invasive species debate is at its core about control: it is dominated by the fear of a "noncompliant nature," of nature not providing anymore the raw material for the extractivist economy (Kim 2015, 152). The argument thus accentuates the "*social* nature" of species (Franklin 2011, 196 [original emphasis]).[146] The non-compliance of invasive animal or plant species is transferred to the undesirability of human "invaders:" The seemingly unbiased, ecological debate on invasive species serves as a naturalization of nationalist and racist campaigns against human immigrants and immigration as such. Human migrants are thus animalized, and nonhuman invasive species are racialized (Kim 2015, 153).[147]

145 The planetary boundary authors define resilience as the "capacity of the Earth system to persist in a Holocene-like state under changing conditions" (Steffen et al. 2015, 1259855-2).

146 The hybridity of the category of "species" itself adds to the controversy of defining invasive species. The traditional "fertility argument"—if two subjects can reproduce, they constitute a species—does not apply to a number of species that can reproduce with members of other species. Further, such a definition relies on a problematic "reprocentric" mindset: a species' "success" is measured in its capability to reproduce. "Healthy" habitats are those where by definition heterosexual reproduction is flourishing. When species engage in erotic activities without reproduction, the habitat must be unhealthy, contaminated. Although the world is full of non-reproductive sex, it is "frequently read as a sign of ecological decline"—a remainder of the nineteenth century where homosexuality was seen as a degeneracy caused by environmental factors such as urbanization and industrialization (Mortimer-Sandilands and Erickson 2010, 10–11).

147 Depending on their positive or negative impact on the economy, native species can become nonnative and invasive (Tuminello 2013, 502); conversely, profitable non-native species can become "naturalized" (Franklin 2011, 213–14). The "charisma" and beauty of species also plays a role in their naturalization; examples for such naturalized species are deer or trout (Franklin 2011, 213–14), and wild horses and boars in the United States (Tuminello 2013, 502). The designation of invasive species depends very fundamentally on whether species "behave" or not, whether they conform to human expectations or economic plans (Besek and McGee 2014, 89). Migrants are compared to "invasive species" that threaten the health of local ecosystems, occupy their niches, drive away its "rightful" inhabitants, "socially pollute" (Olsen 2000, 74), and, eventually, destroy them. In reality, the "more economically threatening a species is perceived to be, the more deeply it is racialized" (Kim 2015, 155). Unmistakably, the analogy is made to a disruption of the "natural" societal order and its legitimate members. "In the same way that ecology matches the right organisms to a given ecosystem, nationalism matches the right people to the right territory" (Franklin 2011, 198). The "nationalist fantasy" of native animals contains national legitimacy as land owners,

3.2.3 Modernization theory and development

> "Historical change cannot be linear, one-directional, sequential, or total."
> (Quijano 2000, 554).

The ecologization of the social and the naturalization of dominion equally manifest in sociological theory. The modernization theory of the 1960s (Rostow [1960] 1991) provided such a reductionist, plant-like account of society. Modernization theory postulates a linear development of all human societies that culminates in the "modern" Euro-colonizer, or Minority World, civilization. In this perspective, countries of the Majority World are still "developing" and must make up for lost time on their way to the top. The reasons for their "underdevelopment" are said to be internal, endogenous factors like "traditional" political structures, inner conflicts, insufficient integration into the world market, and so on. It is the "noble duty" of the Minority World to support these countries in their "development" through investment in key industries and transfer of know-how.

Modernization theory might be academically outdated, but still lurks today in global politics and, unsurprisingly, in development policies. The whole idea of development itself implies that there is one unique, universal direction for all human societies to grow and "ripen" (Rist 2014). The specific and separate historic path of the Minority World is then labeled "development" and applied onto other countries to blame them for their "underdevelopment" (Mohanty 1984, 352–53). This unidirectional evolutionism was an important feature of colonial relations, too. Europe was and is comprehended as the final stage, the culmination of the evolution of civilization, according to the sociologist Quijano (Quijano 2000, 542):

> "the Europeans persuaded themselves, from the middle of the seventeenth century, but above all during the eighteenth century, that in some way they had autoproduced themselves as a civilization, at the margin of history initiated with America, culminating an independent line that began with Greece as the only original source. Furthermore, they concluded that they were naturally (i.e., racially) superior to the rest of the world, since they had conquered everyone and had imposed their dominance on them" (Quijano 2000, 552).

it reinforces national values, and transports that "others" are not welcome (Franklin 2011, 197–99). Nature is portrayed as part of the (white) nation (Kim 2015, 153; Lidström et al. 2016, 25).

Any non-European culture is relegated to a form of "ignorant, uncivilized past," or "state of nature" (Quijano 2000, 552–53).[148] The superiority of the European colonizers was underpinned and naturalized via the social construct of *race* (Quijano 2000, 534–35).[149]

Modernity is thus closely interconnected with coloniality. Latin American subalternists understand coloniality and modernity as "two sides of a single coin" (Grosfoguel 2004, 327; Ramnath 2011, 29–30)—especially as modernity maintains itself through constant primitive accumulation processes in former colonies (Assis Teixeira and Rocha Franco 2015). Quijano's "coloniality of power" (2000) encapsulates the colonial nature of modernity. Today, the "core zones" of the capitalist world system (Wallerstein) still dovetail with predominantly white societies, and racial/ethnic hierarchies are constitutive of the global division of labor (Grosfoguel 2004, 320).[150] In addition to the colonial aspect, Hornborg grasps modern development as a "spatially restricted process of capital accumulation" which in modernization theory is just passed off as temporal difference (Hornborg 2009, 245). It is not perceived as "here" in terms of a local specificity, but as "now" in terms of a chronological universality. With this move, inequalities in societal space are defined as different stages in time (Hornborg 2009, 256).[151]

3.2.4 Imperial sustainable development

> "In the early phases of colonization, the white man's burden consisted of the need to 'civilize' the non-white peoples of the world—this meant above all depriving them of their resources and rights. In the latter phase of colonization, the white man's burden consisted of the need to 'develop' the Third World, and this again involved depriving local communities of their resources and rights. We are now on the threshold of the third phase of colonization, in which the white man's burden is to protect the environment—and this too, involves taking control of rights and resources

148 As a matter of fact, for Quijano, the dualisms "primitive-civilized, magic/mythic-scientific, irrational-rational, traditional-modern" can all be linked to the Europe/not Europe dualism (Quijano 2000, 542). In addition, these dualisms feed into the current, Eurocentric developing/developed distinction (Winant 2000, 174).

149 Taken all together, these elements—evolutionism, dualisms, and naturalization of power differences through race—are constitutive for Eurocentrism (Quijano 2000, 552–53). In Blaut's terms, the dominant Eurocentric view of the centre (Europe) versus the "otherwise sterile periphery" is the "colonizers model of the world" (Blaut 1993, cited in Evren 2012, 314).

150 Current discussions of a "post-colonial," "decolonial" or "post-racial" world (Harper 2010b, 20) obscure the continuation of racial and colonial hierarchies (Grosfoguel 2004, 320). According to Winant: "Despite the enormous vicissitudes that demarcate and distinguish national conditions, historical developments, roles in the international market, political tendencies, and cultural norms, racial differences often operate as they did in centuries past: as a way of restricting the political influence […] of all those at the bottom end of the system of social stratification" (Winant 2000, 182).

151 More generally, anarchist decolonial scholar Ramnath defines modernity as

> "The expansion of the rationalized state, functioning through mechanisms of surveillance, policing, discipline: governmentality exercised through bureaucratic enumeration and management of populations, resources, and so on; and the recognition of such a state as one unit among a mutually reinforcing system of units; The incorporation of more and more goods, commons, natural resources, land, water, labor, time, space, minerals, crops, genetic information, cultural materials, raw materials, manufactured/processed products into the logic of a global capitalist economy, subject to quantification as alienable and exchangeable commodities on the world market rather than local use values; An exponential increase in technology, industrialization, scientificity—especially with regard to communication and transport—and the fossil-fuel-based energy regime" (Ramnath 2011, 28–29).

> […]. The salvation of the environment cannot be achieved through the old colonial order based on the white man's burden. The two are ethically, economically and epistemologically incongruent"
> (Mies and Shiva 1993, 264–65, quoted in Banerjee 2003, 143).

Mies and Shiva draw a line from colonialism, development, to environmental protection. Hence, the theme of imperialism is detectable not only at the roots of modern (white, affluent) environmentalism but also in contemporary environmental politics, such as the view of sustainable development as a universalist, white "savior fantasy" (Franklin 2011, 195). The impartial character and universalism of the environmental discourse hides its political aspect. Environmental conservation is almost always a form of control (Peet, Robbins, and Watts 2011, 28); it demands an authority who decides what should be conserved, and how. This authority is, today, most often the (colonial) state, granting property rights to itself, or to individuals and corporations. Consequently, conservation can lead to more corporate power over resources (Peet, Robbins, and Watts 2011, 27–31). Similarly, sustainable development serves as a way of managerial control of the Majority World (Baker 2007, 301–2). The Minority World, with its environmental regulations, passes both as the green avant-garde and as a yardstick for the "bad pupils" in the Majority World, according to modernization theory. It is perceived as necessary to regulate, control, and redirect the dealing with nature in the Majority World along the lines of this shining green example—ultimately, in favor of green capitalism. For post-development theorists,[152] sustainable development is an attempt to sell old wine in new bottles, masking the failure of the development concept with appealing, green adjectives (Morse 2008, 343).[153] "The Third World, still in need of development, now needs to be told how to develop sustainably" (Banerjee 2003, 174). Although most colonies are officially abolished, the colonizer/colonies relationship is perpetuated in "North/South," "developed/developing," and likewise in sustainability discourses and practices. For Banerjee, commonalities of coloniality and sustainable development are "the domination of physical space, reformation of the natives' minds (particularly in terms of knowledge systems and culture), and incorporation of local economic histories into a Western perspective." Sustainability relies on a colonial mindset, either by the picture of the "pristine nature" that must be conserved, or the "savage wilderness" that must be tamed and managed through Minority World technology. The physical space is governed by such diverse practices like biodiversity management, ecotourism, or eucalyptus plantations absorbing carbon dioxide (Banerjee 2003, 148). In the Minority World, on the other hand, biodiversity has been severely decreased, among others via the drainage of European wetlands in the eighteenth and nineteenth

152 The post-development movement generally critiques the top-down, hierarchical discourse on development, the colonial gesture of rich nations to influence and, again, rule over "developing countries," and the failure of development to eradicate hunger, install social justice, etc. as such (Morse 2008, 341–42).

153 Sustainable development is yet another form of Minority World hegemony, "nice sounding words and ideals, but in fact nothing more than business as usual given that 'progress' equates to consumerism, industrialization and inevitable pollution." (Morse 2008, 343).

centuries in order to get rid of malaria (David Simpson 2011, 18); biodiversity management, the securing of the remaining genetic resources, thus ultimately accommodates the Minority World's interests (Doyle 1998, 776–77). Conservation projects have, in some cases, been perpetuating such a colonial environmentalism; for instance, the establishment of many national parks or reserves by urban Euro-settler elites has expropriated and expelled its original inhabitants (Peet, Robbins, and Watts 2011, 27).[154]

3.2.5 "Unsustainable" population versus Imperial mode of living

Environmental discourse continues to include not only imperial, but also the "class hygiene" and Malthusian arguments mentioned above. "Unsustainable" human overpopulation and poverty are depicted as causes for environmental degradation (Hajer 2000, 263; Lélé 1991; Passadakis et al. 2009). Nonetheless, the contention against population growth relies on an error of category. Between 1820 and 2010, humanity grew by a factor of 6.6. Meanwhile, carbon dioxide emissions rose by a factor of 654.8:

> "David Satterthwaite juxtaposed rates of population growth to rates of emissions growth in the quarter-century between 1980 and 2005, and found that numbers tended to rise fastest where emissions grew slowest, and vice versa (Satterthwaite 2009). The rise of population and the rise of emissions were disconnected from each other, the one mostly happening in places where the other did not—and if a correlation is negative, causation is out of the question. A significant chunk of humanity is not party to the fossil economy at all: hundreds of millions rely on charcoal, firewood or organic waste such as dung for all domestic purposes. Satterthwaite concluded that one-sixth of the human population 'best not be included in allocations of responsibility for GHG emissions' (Satterthwaite 2009, 547–50). Their contribution is close to zero. Moreover, 2 billion people, or nearly one-third of humanity, have no access to electricity" (Malm and Hornborg 2014, 65).

In conclusion, what is decisive is not necessarily the number of people but their way of production and consumption. 20 percent of the global population consumes 80 percent of the world's resources. Still, poverty is seen as the number one threat to the environment, as the primary cause of degradation. "The poor" are portrayed as a globally homogeneous category (Doyle 1998, 776), and affluence and industrialization are seldom problematized. Banerjee draws a

154 Those forms of environmental protection have been labeled "environmentalism of the rich" (Avila-Garcia and Sánchez 2012). Avila-Garcia and Sánchez describe how conservation and biodiversity "protection" mainly occur for the benefit of tourism and private investors and do not "structurally disturb the logic of capitalist accumulation." (Avila-Garcia and Sánchez 2012, 54). The "environmentalism of the poor," conversely, has a very different aspect (Guha 2000; Martinez-Alier 2002): it is about resistance, a struggle for survival, for the protection of land against corporate projects, pollution, and aggressive biopiracy. Banerjee almost cynically describes the environmentalism of the rich as—after having elegantly exported the extraction of raw materials, nasty industries, and concomitant degradation to the Majority World—being concerned with aesthetics, protecting some endangered species and beautiful beaches to sunbath on (Banerjee 2003, 158–59).

comparison between slash-and-burn agriculture, which is often condemned, whereas huge timber companies are applauded for "sustainable" initiatives. The talk of "global sustainability" deflects criticism of the biggest emitters and the most wasteful industries and globalizes the responsibility for environmental degradation (Banerjee 2003, 157–59). Like this, the Majority World is bearing the dangers and costs of ecological degradation, while the Minority World profits from it (Bullard and Müller 2012, 59). Malm and Hornborg rectify the relationship between greenhouse gas emissions and population:

> "as of 2008, the advanced capitalist countries or the 'North' composed 18.8% of the world population, but were responsible for 72.7 of the CO2 emitted since 1850, subnational inequalities uncounted. In the early 21st century, the poorest 45% of the human population accounted for 7% of emissions, while the richest 7% produced 50%; a single average US citizen—national class divisions again disregarded—emitted as much as upwards of 500 citizens of Ethiopia, Chad, Afghanistan, Mali, Cambodia or Burundi (Roberts and Parks 2007)." (Malm and Hornborg 2014, 64).[155]

The political ecologists Brand and Wissen have theorized this inequality as the "imperial mode of living" which they define as "dominant patterns of production, distribution and consumption" rooted in the "everyday practices of the upper and middle classes" of the Minority World and Majority World. The mode of living is imperial because it appropriates labor power, resources, as well as ecological sinks of the Majority World (Brand and Wissen 2012, 548). A product of geopolitics, trade, corporate strategies, and globalized definitions of a "good life," the imperial mode of living has become normalized and even linked to societal progress (Brand and Wissen 2012, 549). This acceptance and normalization hide the violent character of the imperial mode of living, as it is directly entangled with the "imperiled life" of the Majority World (Sethness 2010). Truly imperial, the lifestyle is conquering the Majority World, in particular China, Brazil, and India. For Brand and Wissen though it is a matter of time until the clashes of the fossilist forms of production and consumption with the ecological limits of the Biosphere become more virulent and violent (2013, 690).

3.3 Controlling and capitalizing on nature

> "How long before bottled fizzy water is reframed as Carbon Capture & Storage?"
> (Haynes 27.08.2015).

155 Finally, people disposing of large economic and cultural capital who think of themselves as "environmentally conscious"—the LOHAS so to say –, in reality have a bigger ecological footprint than people with lower economic and cultural capital and no self-ascribed "green consciousness" (Brand and Wissen 2012, 552). LOHAS stands for "Lifestyles of Health and Sustainability."

"Making America the world's greenest country is not a selfless act of charity or naïve moral indulgence. It is now a core national security and economic interest" (Friedman 2008, 23).
"What could be more patriotic, capitalistic, and geostrategic than that?"
(Friedman 2008, 203, cited in Kenis and Lievens 2015, 70).

Green capitalism's second mirror move is to control and capitalize on nature. The following section scrutinizes the theoretical underpinning of this move: ecological modernization theory, the green version of its predecessor, modernization theory. The section then outlines the basic features of ecological modernization, the corresponding model of "neoliberalizing nature," the perception of nature as a market, and finally, approaches the application of ecological modernization in agriculture: sustainable intensification.

3.3.1 Ecological modernization theory

Ecological modernization is a social theory from the 1980s with a political agenda arguing for a viable and even profitable combination of environmental conservation and economic profit. This arrangement is fostered through voluntary regulations and new technologies (Hajer 2000, 248; 2015, 61). Here, societies of the Minority World are placed on top of a linear, societal development because of their "advanced" industrial environmental protection.[156] Sustainability is framed as a problem of inefficiency which can be solved with a technological fix (Birch, Levidow, and Papaioannou 2010, 2898). In this eco-modernist discourse, *insufficient* industrialization, technological innovation and growth are the root cause of the ecologic dilemma. Consequently, the ecological crisis—which reportedly has been caused by extractivist growth and industrialization—must be counteracted with even more of the same (Hajer 2000, 254). Hajer summarizes five core elements of ecological modernization:

> "(1) it believes "decoupling" of economic growth from environmental degradation is possible; (2) it regards environmental degradation as a problem of collective action, to be overcome by coordination and better incentive setting; (3) it makes environmental damage calculable hence it seeks to allow for an analysis of costs and benefits of environmental pollution; (4) it seeks to internalize environmental costs into mainstream calculations, whether that is on the level of **business and corporations** or in terms of the analysis of macro-economic performance, thus 'greening the economy'; (5) it has a firm belief in the potential of technological and social innovation." (Hajer 2015, 61–62 [original emphasis]).

156 Moreover, these (neither transparent nor disinterested) "green" production standards in the Minority World broaden the gap between corporations in the Majority World that are unable to comply with these environmental regulations (Redclift 2005, 217).

The Environmental Kuznets curve hypothesis is an example of ecological modernization theorizing. The curve represents environmental degradation as an inverted U-shaped curve relative to affluence. It states that the early stages of development and economic growth are marked by environmental degradation; nonetheless, with rising affluence, nature becomes a "luxury good" that will be protected. Empirical studies actually show that the Environmental Kuznets curve can apply to a local context, if it is, for example, a matter of air pollution. However, on a global scale, economic growth in fact aligns with environmental degradation. This is because a country simply externalizes its production sites and waste to other nations; and predominantly, this transfer goes from the Minority to the Majority World. In consequence, a country never genuinely reduces, but in contrast exports its environmental effects (Besek and McGee 2014, 82–83). Indeed, the resource consumption of the Minority World has steadily grown since the mid-1980s. Resource extraction in the Minority World itself has diminished. Conversely, the import of resources from the Majority World, and the export of its waste to the Majority World have multiplied (Brand and Wissen 2013, 697). This relocation of environmental hazards in "clean" production schemes to other, more powerless places disqualifies the Environmental Kuznets curve.[157]

Regardless of this externalization, ecological modernization argues that it is not only *possible* to solve the environmental crisis with innovation, management, and economic growth, it is even a win-win situation (Hajer 2015, 61). This striking reflection can perhaps be summarized with the revised saying that you can "have your cake *and* eat it" (Szerszynski 2000, 130). Ecologic regulations are now even expected to enhance economic productivity, fostering innovations and business opportunities and thus being an engine for growth (Hajer 2000, 248–49). Public-private partnerships are more and more important; the crisis of multilateralism (as apparent in climate change negotiations) has conferred leadership opportunities upon the business sector (Wichterich 2015, 72). The new "corporate social responsibility" departments of corporations (and non-governmental organizations) install "flanking measures" for the "community"—services that were, it is understood, formerly provided by the state, and that are expected to mitigate environmental degradation (Birch, Levidow, and Papaioannou 2010, 2900; Castree 2008a, 142, 147).

3.3.2 Neoliberalization of nature

Presenting itself as the *only* developmental path (Pepper 1998, 3), ecological modernization furthers not only an economic agenda, but a social and environmental project, as well (Hajer 2000, 257). It is a rationalization and technicization of ecology, converting it from a social issue

157 Besides, efficiency gains in production are generally neutralized by higher output and consumption, a situation called "rebound effect" and theorized as the "Jevons' Paradox" (Alcott 2005; Langhelle 2009, 412).

into a market (Hajer 2000, 262–63), hence the designation of "free market environmentalism" (Castree 2008a, 147; Pepper 1998, 5). Its foundation is the "neoliberal ethic:" that the free market should be the core principle ruling or governing our life, our economic, political, social, and environmental relations (Birch, Levidow, and Papaioannou 2010, 2900).[158] Indeed, ecological modernization is an innately neoliberal project, and corresponds to a "neoliberalization of nature" (Castree 2008a; 2008b). Nature is neoliberalized through a variety of—sometimes contradictory—processes: Nature is privatized (meaning that formerly communally owned, un-owned, or state-owned environmental phenomena like land are privatized), and marketized (meaning that phenomena which had no price before and/or have not entered the global market now enter market exchange), which will be examined more thoroughly in the following subsection. Nature is liberalized, for example in resource trade. Nature is deregulated and re-regulated: environmental protection is deregulated, "rolling back" the state and its interference in environmental matters; while new environmental regulations are enacted (Birch, Levidow, and Papaioannou 2010, 2900; Castree 2008a, 142, 147).

As a managerial response to the environmental crisis, ecological modernization was a decisive break with the ecological discourse of the 1970s. In point of fact, it is the neoliberal, repressive answer to the radical environmental movement of the 1970s that demanded revolutionary change and not mere reforms. Ecological modernization silenced contentious disputes and antagonistic issues of the decade (Hajer 2000, 248–49; 2015, 61–62), along with co-opting the terminology of transformation of the environmentalists (Wichterich 2015, 71). The success of the eco-modernist discourse was confirmed by its adoption in the Brundtland Report in 1987—the hallmark document of ecological modernization—and in the Agenda 21 at the United Nations Conference of Environment and Development in Rio 1992 (Hajer 2000, 249, 254). The green economy was one focal point at the United Nations Conference on Sustainable Development in Rio 2012 (Jessop 2012). Today, ecological modernization manifests in policies around the world and in organizations like the OECD, the World Bank, and the International Monetary Fund (Hajer 2015, 62). The thesis will examine its expression in international food and agricultural institutions like the FAO and in the animal-industrial complex more broadly.

3.3.3 Nature as a market

In the view of ecological modernization, former attempts to discursively grasp environmental protection, like "nature conservation," failed: these attempts gave nature an intrinsic value that could not be operationalized (Fish, Winter, and Lobley 2014, 55). Ecological modernization,

158 Kim defines neoliberalism, taking off in the 1970s, as "the implementation of certain types of policies—fiscal austerity, privatization, market liberalization, and governmental stabilization—designed to promote the operation of free markets and stymie any public efforts to impede or control them. […] What is distinctive under neoliberalism is the aggressive pervasion of market values into many previously nonmarketized aspects of social and political life" (2015, 142).

then, successfully conceptualized nature as a market, albeit "the protection of nature is ultimately for the purpose of its enlightened exploitation" (Rolston III 2001, 403). This discursive transformation of nature into natural resources and hence the conflation of business with the nonhuman environment resulting in a "green economy" constitute a quite singular evolution in human history (Luke 1995, 58).[159]

To not only discursively transform nature into a market, resources have to be propertied. According to ecological modernization theory, establishing such property rights and then determining their price, ensures the sustainable exploitation of resources and avoids the "tragedy of the commons" (Pepper 1998, 5). Nature should not be regarded as a sink or a free good (Hajer 2015, 28). In this form of neoliberal primitive accumulation, traditionally common goods are privatized for corporate profit and local communities are stripped of their usage rights.

However, it is not only the use of natural resources that is commoditized; pollution is as well. Environmental degradation is, according to ecological modernization, a mere "matter of inefficiency" that can be resolved through the right technology and regulative framework (Hajer 2000, 249; Szerszynski 2000, 116). Damage can be integrated into economic calculations as an externality (Hajer 2000, 251).[160] Carbon dioxide emission certificates are a prominent example of allocating a price to environmental damage (Langhelle 2009, 395). Creating such tradable certificates was one of the principal strategies of the United Nations Framework Convention on Climate Change (signed at the Rio Conference in 1992 and put into force in 1994), and the Kyoto Protocol (signed in 1997) to combat climate change. The Convention and the Protocol aimed to make institutions pay for their emissions, thereby boosting the efficiency of production (Brand and Wissen 2013, 696). Under the Kyoto Protocol's offset scheme "Clean Development Mechanisms" for instance, affluent countries invest in mitigation projects in the Majority World and can thereby meet their own national mitigation obligations (Gerber et al. 2013, 93). The Rio Conference further gave birth to the Convention on Biological Diversity which became binding international law in 1993. To protect biodiversity, its chief approach was to commercialize genetic resources (Brand and Wissen 2013, 696–97).[161] Deutsch, Lannerstad, and Ran from the Stockholm Resilience Centre highlight the importance of biodiversity conservation in unambiguously economic terms:

159 Luke observes a discursive shift from the terms "nature" to "environment" in the second half of the twentieth century, and progressively, the environment is broken down to its (alleged) parts—like ecosystems—in order to measure it (1995, 60–63).

160 Externalities are economically defined as "situations where a market exchange imposes costs or benefits on others who aren't party to the exchange" (Stiglitz 2010, 15).

161 The access and gains of such commercialization are still up to negotiation (Brand and Wissen 2013, 696–97).

> "Maintaining this natural capital, with a portfolio of species, provides insurance that the system will be able to cope with disturbances and shocks, such as fires or pest outbreaks, and still continue to provide desired ecosystem services, e.g. feed crops, and if damaged, rebuild and regain productivity" (Deutsch, Lannerstad, and Ran 2011, 7).

"Paying to conserve," "selling it to save it," aligning preservation with economic processes, or, more generally, the capitalization of nature, is thus not mere discourse but has resulted in concrete policies. Other cases besides carbon trading or biodiversity are "natural capital accounting" or "green accounting,"[162] the United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+) initiative, and payments for Ecosystem Services (Wichterich 2015, 73). Despite the allegations of mythology discussed in the paragraph 3.2.2, and the difficulties of setting spatial and temporal boundaries, ecosystem theory is still alive and kicking.[163] Payments for Ecosystem Services is a utilitarian, policy-oriented framework and defines nature as a "system producing flows of *benefit*" (Fish, Winter, and Lobley 2014, 55 [original emphasis]). Still, although it is widely recognized that ecosystems are of immense value, their exact financial valuation lacks consensus. This is especially the case for services delivered to a global public. Existing estimates of global ecosystem services are criticized either for "underestimating infinity" or for calculating a numerical value that exceeds global income which in turn would make it impossible to account for any damage (David Simpson 2011, 6–7).[164] This dilemma challenges the purpose of measuring nature with money in the first place, which ignores incommensurable values like aesthetics or sacredness, and the ethical and political aspects of resource use and territorial rights (Fish, Winter, and Lobley 2014, 53; Rodríguez Labajos and Martinez-Alier 2013).[165]

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162 Green accounting is "a popular term for environmental and natural resource accounting, which incorporates environmental assets and their source and sink functions into national and corporate accounts" (Rodríguez Labajos and Martinez-Alier 2013, 493).

163 Two prototypical institutions evaluating ecosystems are the Millennium Ecosystem Assessment, a multi-million USD enterprise by over 1,300 scientists analyzing change of ecosystems and their services (with the insight that 15 of the 24 scrutinized ecosystems were being degraded); and the Intergovernmental Platform on Biodiversity and Ecosystem Services (David Simpson 2011, 4–5).
As ecosystem theory is still the dominant paradigm in ecology, parts of this thesis, especially in chapter 2.3 on planetary boundaries, equally—albeit sceptically—rely on studies clearly taking ecosystems as their analytical point of departure.

164 In 1997, Costanza et al. have assigned an average yearly value of 33 trillion USD to the entire biosphere (Costanza et al. 1997). An updated version of the paper augments the figure to 125 trillion USD (Costanza et al. 2014).

165 Still, in this world dominated by numbers, it can be an interesting thought experiment to contrast the revenues from ecosystems with the damages done to them. The Think Tank Trucost examined the profits of the biggest industries worldwide, and then contrasted those figures with the externalized costs of environmental degradation (assessing the costs of emissions, water consumption, land use, waste, and air, land and water pollution). Whereas almost no business would be profitable would it internalize the costs, the livestock industry shows the biggest discrepancies regarding revenue and caused damage. The natural capital cost of global cattle ranching and farming constitutes 710 percent of its revenue, meaning that it causes more than 7 times more resource-damage in monetary terms than it actually makes. For South America, the ratio is particularly high: 353.8 billion USD in natural capital costs opposed to a revenue of 16.6 billion USD, which equals a ratio of 18.8 (Trucost 2013, 9).

3.3.4 Sustainable intensification

In contemporary agriculture and in the Livestock Revolution a policy field in line with ecological modernization is sustainable intensification. In true fact, the Livestock Revolution and the highly inefficient production of animal protein are the primary reasons why there is a perceived need for sustainable intensification—and, as will be shown in chapter five, sustainable exploitation of farmed animals—in the first place. The industry-model of sustainable intensification literally unites the two principles of innovative environmental protection ("sustainable") and old-fashioned economic growth, or productivity increase ("intensification").

In their article "Sustainable Intensification in Agriculture: Premises and Policies," Garnett et al. define sustainable intensification as

> "a call to increase food production from existing farmland in ways that place far less pressure on the environment and that do not undermine our capacity to continue producing food in the future." (Garnett et al. 2013, 33).

While sustainable intensification has been integrated in national and international policies (the FAO has been working with sustainable intensification since the 2000s, and it is a policy priority through the "Save and Grow" program,[166] there is also a growing contestation of the concept (Garnett et al. 2013, 33).[167] The term is simultaneously viewed as an oxymoron, a description, or an aspiration.[168] Essentially, there are two competing paradigms. The first paradigm is a continuation and expansion of high-tech, industrial agriculture, known for mechanization, simplification of crop management, heavy machinery, increased input of external resources, bigger dependency on fossil fuels and technology, and exploitation of economies of scale. In 2009, the Royal Society's publication "Reaping the Benefits"—the most quoted reference on sustainable intensification—summarized that "no techniques or technologies should be ruled out" (The Royal Society 2009, ix). This statement served as a legitimization to label all sorts of biotechnology as

166 "Save and Grow" is a strategy for "sustainable crop production intensification through an ecosystem approach" and is being promoted in Africa, Asia, Latin America, and Europe (COAG FAO 2014). See also FAO 2011c; 2016i.

167 The FAO Homepage on "Sustainable Crop Production Intensification" reads:
"The need to feed a growing population is a constant pressure on crop production, as is coping with an increasingly degraded environment and uncertainties resulting from climate change—and the need to adapt farming systems to these. Sustainable crop production intensification provides opportunities for optimizing crop production per unit area, taking into consideration the range of sustainability aspects including potential and/or real social, political, economic and environmental impacts.
Recent trends would indicate that the incorporation of scientific principles of ecosystem management into farming practices can enhance crop production (yield). With a particular focus on environmental sustainability through an ecosystem approach, sustainable crop production intensification aims to maximize options for crop production intensification through the management of biodiversity and ecosystem services" (FAO 2016j).

168 The origins of sustainable intensification de facto lay in African small-holder agriculture (Garnett and Godfray 2012, 8). Today, it is instead considered the successor of the Green Revolution (Collins and Chandrasekaran 2012, 5).

"sustainable," including genetic and ecological engineering.[169] Agribusiness and multinational biotech companies have subsequently been advertising their methods and products under the guise of sustainable intensification (Collins and Chandrasekaran 2012, 5). In this approach, sustainability is solely defined as "eco-efficient productivity" that supports the future accumulation of capital (Birch, Levidow, and Papaioannou 2010, 2913). Boyd, Prudham, and Schurman reflect:

> "The desired result, of course, is higher yields, shorter turnover times, improved disease resistance, etc. Nature, in short, is (re)made to work harder, faster, and better." (Boyd, Prudham, and Schurman 2001, 564).

The second paradigm is agroecology.[170] Agroecology, in turn, asks for a fundamental change in agriculture. Building on local farmers' and indigenous knowledge and resources, and paying attention to the social and economic context, it aims to maintain biodiversity and ecosystem services, such as pollination, soil fertility, water use, pest and disease control (Meyer 2014, 15).

The "harder, faster, better" framing of sustainable intensification assumes that food production must augment significantly (additional 60-120 percent) to feed the growing world population by 2050.[171] The academic discourse and policy documents are fixated on the supply-side of higher yields, without ever touching upon the demand-side of reforming consumption, in particular the consumption of highly inefficient animal foods (Garnett and Godfray 2012, 12). Garnett and Godfray maintain that it is "inaccurate to link sustainable intensification with a defined requirement for a specific increase in food production. The link between the two must be broken" (Gar-

169 The world's largest fertilizer corporation, Yara International, for instance, is a sponsor of climate smart agriculture, a sustainable intensification strategy promoted by the World Bank (Collins and Chandrasekaran 2012, 6–7). Another instrument of sustainable intensification is precision agriculture, "digital agriculture," or "information-based crop management," defined as the "spatially variable management of crop production." Precision agriculture is applied in all the stages of production, applying nutrients or manure, controlling weed, managing water and diseases. Advanced and new technologies are applied, such as "satellite-supported positioning systems, yield mapping, remote sensing, sensor technologies, geo-information systems, various rate application techniques, and decision support systems" (Meyer 2014, 15).

170 One definition of agroecology is "the integrative study of the ecology of the entire food systems, encompassing ecological, economic and social dimensions, or more simply the ecology of food systems." (Francis et al. 2003, quoted in Wezel et al. 2009, 3). Agroecological research can take place on three different scales: on the plot and field scale, on a farm and agroecosystem scale, and at a global scale, investigating the whole food system. Nevertheless, in addition to being a scientific discipline, agroecology constitutes a farming practice and a social and political movement. Its interpretations differ from country to country. Primarily in Germany, it is an academic discipline, in France, a farming practice, in Brazil, a movement, in the United States, a science and social movement. In Brazil, the agroecology movement promotes small-scale agriculture, rural communities, food sovereignty and autonomy (Wezel et al. 2009). In Latin America, while building on indigenous farming traditions, agroecological practices include "conservation of natural resources, adapted soil fertility management and conservation of agrobiodiversity" (Wezel et al. 2009, 4).

171 In fact, at a 2008 United Nations world food security conference, the FAO argued that food production must be doubled in order to feed the growing human population. Though the claim has been relativized since, the message has taken hold (Collins and Chandrasekaran 2012, 5).

nett and Godfray 2012, 15). Yet, the productivist model still pushes for boosting yields. Concerns about famine and "overpopulation" (Collins and Chandrasekaran 2012, 23) are instrumentalized to justify intensification and agricultural expansion, structural changes, and extension of private property regimes (Birch, Levidow, and Papaioannou 2010, 2910).[172] Yet, instead of feeding the people, such processes are ultimately feeding corporate profits. They have a top-down approach involving scientists rather than the farmers themselves, they promote hybrid seeds, genetic modification, or biofortification, and prioritize global supply chains over local food sovereignty (Collins and Chandrasekaran 2012, 15):[173]

> "Sustainable intensification claims to include agro-ecological farming practices but in practice seems to focus primarily on technology-based approaches. It aims to help small farmers but is driven by the agendas of corporations, the science establishment and international donors" (Collins and Chandrasekaran 2012, 22).

3.4 Ecological contradictions and evasion

As one might guess, the promise of ecological modernization and, ultimately, of sustainable development, that is, the promise to combat the ecological crisis with environmental regulations and "poverty" with green growth, has shown itself to be unfulfilled and unfulfillable. Global inequality and environmental destruction continue to escalate (Foster 2003; Görg 2011, 43–44). Humanity is facing an ecological collapse—156 percent of the Earth's biocapacity was used in 2012 (Global Footprint Network 2016), and this notwithstanding nearly fifty years of international efforts to attain sustainable development.

The basic contradiction of capitalism is that it is based on endless growth in a world with finite resources. Further, it exploits nature in such a way that it undermines its own basis of existence (Görg 2011, 50). A similar paradox is that human beings have become the biggest power on Earth and have altered the environment according to their needs (or, mostly for the needs of capital; compare critical accounts of the Anthropocene: Malm and Hornborg 2014; Moore 2014a; 2014b), yet, they seem to have no remedy to counter the increasing number of environmental catastrophes and crossings of planetary boundaries.

172 In reality, small-scale farmers provide the bulk of domestically consumed food in Africa, Latin America and Asia, and not industrial agriculture (Collins and Chandrasekaran 2012, 22).

173 Genetically modified organisms are traded as one sustainable intensification strategy. The four major genetically modified crops are soy, maize, cotton and oilseed grape—none of them are primarily produced for food purposes. The majority of soy and maize are used as animal feed, cotton is a cash crop, and oilseed grape is primordially processed for edible oil, but increasingly used in biofuels (Collins and Chandrasekaran 2012, 16).

In addition, at no point in history has the scientific understanding of the human impact on the biosphere been greater, and more widely shared by people everywhere. Still, this information does not lead established forms of politics to take action on a global level (Biro 2011, 4–5; Brand and Wissen 2013, 688). What are the reasons for this paradoxical situation? There is a sort of "willful [sic] production of ignorance and scientific ambiguity" when it comes to knowledge about environmental crisis.[174] A strategy of evasion and distraction is to side-track the catastrophe to occur "sometime" in the future. Climate change is a prominent example where legitimacy and the authority of knowledge—as in the case of the Intergovernmental Panel on Climate Change—are questioned by powerful actors like governments or corporations. Governments, for example, fear that slowing down the fossilist economy would be economically and socially troublesome, and then they shift the problem to the international sphere, to UN "Earth Summits" and "non-enforceable Protocols" (Peet, Robbins, and Watts 2011). Sanbonmatsu notes, referring to the Parisian Climate Change Summit COP21:

> "A top stage illusionist like David Copperfield can make a Lamborghini vanish right under the noses of his audience. But that is nothing compared to what played in Paris, where the world's political elites made the global warming crisis itself disappear—by creating the illusion of decisive action, where in fact there was nothing.
> […] [T]he illusion of action in Paris may in fact prove worse than no action at all. For it has left the public with the mistaken impression that the climate crisis is now going to be dealt with, perhaps even solved, on the cheap, in half-measures, and without disturbing the powerful economic and social forces that profit from ecological destruction. And that is the greatest deception of all" (Sanbonmatsu, January 07, 2016).

Ecological modernization thus magically manages the crisis through first, giving the impression of solving the crisis via externalizing the damages to the Majority World, and second, by its valorization in capitalist terms, by making money with it (Brand and Wissen 2013, 692–93). Still, glossing over the issues with a thick green polish does not really make them disappear. Global capitalism still depends on the overuse of natural sinks and resource exploitation (Brand and Wissen 2012, 548). In essence, ecological modernization disregards the biophysical contradictions of capitalism—the limits to growth in the finite system of Earth (Hajer 2000, 255; 2015, 61): the very same limits defended in the 1970s, before sustainable development was co-opted by green capitalism. Boggs concludes:

174 Notwithstanding the serious evasion and deceptions, the reliance on expert knowledge poses problems as well. Whereas science is a fundament of political ecology, science is historically also a part of the problem. Science is not value-free, it is developed and conducted with a specific interest, and today often stems from powerful actors, such as the military. Science from the Minority World overrides local, traditional knowledge, so Peet, Robbins, and Watts (2011, 31, 38, 40). The question remains: If the paramount degradation has been caused by the Minority World, why should the solutions stem from the very same actor? (Bullard and Müller 2012, 59; Hajer 2000, 258).

> "Spurred by unfettered corporate expansion, neoliberal globalization thus subverts ecological balance by its very logic, and an often neglected component of this downward cycle is animal-based agriculture. Neoliberalism legitimates its unsustainable practices on a foundation of technocratic arrogance, mythological belief in free-market economics, an instrumental view of nature, and contempt for other species." (Boggs 2011, 79–80).

To wrap up this critical overview of ecology, sustainable development, and green capitalism, the relationship between the used concepts should be clarified, albeit in a simplified, but notwithstanding instructive manner.

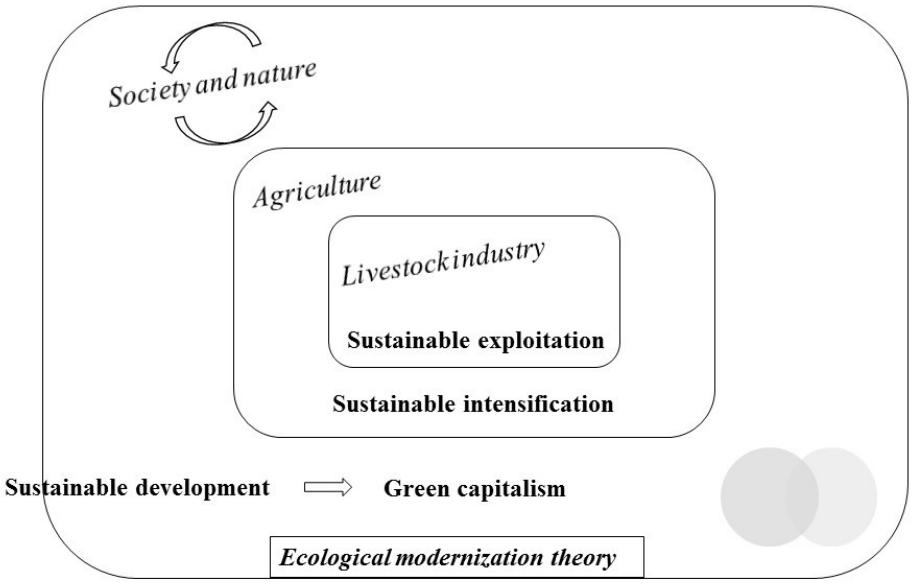

Figure 7: Terminological clarification.

Figure 7 illustrates the rapport between the terms sustainable development, ecological modernization theory, and green capitalism on the one hand, and sustainable intensification and the proposed term of "sustainable exploitation" on the other.

The first box represents society and nature, standing in a dialectic relationship. Green capitalism is perceived as an economic and social order, and therefore also a system ordering nature. The origins of sustainable development in the 1970s, on the other hand, encompass ecological theory that criticized resource exploitation in capitalism (Georgescu-Roegen 2013) and that claimed that endless economic growth—the basis of capitalism—was not feasible in a finite world.

However, the neoliberal decades of the 1980s and 1990s, the neoliberalization of nature and the reduction of sustainable development to green growth transformed sustainable development theoretically and practically into green capitalism. The theoretical fundament for this transformation is ecological modernization theory.

Within this form of socio-ecological relations, there are agricultural practices. One such practice is sustainable intensification, outlined in subsection 3.3.4. One crucial share of contemporary agriculture is the livestock industry. For the livestock industry, this thesis proposes that the term “sustainable exploitation” is parallel to sustainable intensification in agriculture. The term aims to underscore the commodification of sentient beings and the bloody and violent character of the complex.

Finally, the sketch bears the form of a credit card in order to accentuate the common core of those theories and practices: the profit imperative.

4 METHODS

With the linguistic turn in social sciences, and the growing importance of communication and media, sociological discourse analysis has become increasingly popular.[175] In its most radical sense, the linguistic turn designates that there is "no knowledge of reality which is independent of language, or discourse, […] *all* knowledge is discourse" (Hughes and Sharrock 2007, 328 [original emphasis]). Discourse analysis relies on the view that knowledge is socially conditioned. There is no such thing as "neutral" knowledge: knowledge is a tool of power. As a consequence, public policy scholar Hajer boldly states that "power structures of society can and should be studied directly through discourse" (Hajer 1995, 55).

To study power structures in the animal-industrial complex and to investigate practices of naturalization and capitalization on the basis of stakeholder documents is equally the aim of the following discourse analysis. This chapter lays down the methods of the thesis. After an introduction to sociological discourse analysis, the concrete methodological steps are presented, from the choice of the sample, presentation of core actors to a discussion of the instruments of analysis and interpretation.

4.1 Sociological discourse analysis

First elaborated as a linguistic method, discourse analysis has been transformed and established as a qualitative research method for the social sciences.[176] The work of Foucault has been highly influential in inquiries on hegemonic subjects and social mechanisms of exclusion by the fields of postcolonial, cultural and gender studies. In the last decade, discourse analysis has been institutionalized within the social sciences and has differentiated into a heterogeneous field grounded in social constructivism (Keller 2013, 1, 58–59). German sociologist and discourse analyst Keller (2013) categorizes the most prominent contemporary European streams in discourse analysis as discourse theory (Foucault, Mouffe, Laclau), Critical Discourse Analysis

175 This popularity can be witnessed in the quantitative rise in monographs, book series, journals, conferences, and seminars on the issue.

176 Discourse analysis is indeed primarily a qualitative research method; a purely quantitative approach is very seldom chosen in the field (Lazaraton 2002, 32). Whereas quantitative analysis is interested in numbers, in how often something appears, and is performed rather "mechanically," qualitative analysis inquires into the "why and how" of something, which is the goal of discourse analysis. Nevertheless, this does not obviate the need for small-scale quantitative counts, for instance, in order to estimate the importance of a specific category. To clarify, the insight that a category appears seldom or not at all is also insightful (Lazaraton 2002, 33). Such a quantitative assessment of the use of terms like "nature," "efficiency," or "poverty" in the Livestock Revolution discourse is presented in appendix 3.

(Fairclough, Wodak, van Dijk), the sociology of knowledge approach (Keller) and the German Critical Discourse Analysis (Jäger).[177]

Hajer has examined the environmental discourse of acid rain policies in the UK and the Netherlands. In this early, yet still topical examination, he defines discourse as:

> "A specific ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities" (Hajer 1995, 44).

Discourse analysis studies the (re)production and transformation of this ensemble and, thereby, the (re)production and transformation of social order. Discourse analysis is thus not solely about ideas, but rather about material reality (Jäger and Maier 2013, 168). Policies, for example, only make sense according to a certain definition of a problem (Foucault 1990). To illustrate: today, as migration is *defined* as something negative, it must be prevented. Here, we can engage with Foucault (1994) about the "conditions of existence" of certain ideas and the impossibility of other ideas. Some arguments simply cannot be brought forward. In addition to the argument in question, the source of the claim is also vital. Both what can be said, and who can say it, is restricted. Thus, Hajer calls discourses exclusionary, asserting that "[t]he political conflict is hidden in the question of what definition is given to the problem, which aspects of social reality are included and which are left undiscussed." The aim of discourse analysis is thus to reveal the political conflict and to understand why a certain definition dominates over others (Hajer 1995, 43–44). The normal or mainstream character of some discourses hides its arbitrariness, and that it is a result of negotiation and power play (Hajer 1995, 56–57). Discourse analysis includes observing "how seemingly technical positions conceal normative commitments" (Hajer 1995, 55). To return to the initial statement that discourses are a means to study power structures, in a very fundamental way, discourses are about power. They exercise power "because they institutionalize and regulate ways of talking, thinking and acting" (Jäger and Maier 2013, 166). Keller exemplifies their intervening and dynamic nature by defining discourses as

> "more or less successful attempts to stabilize, at least temporarily, attributions of meaning and orders of interpretation, and thereby to institutionalize a collectively binding order of knowledge in a social ensemble" (Keller 2013, 2).

On a practical level, the basis, or primary data of discourse analysis are texts. Yet, in contrast to linguistic discourse analysis, sociological discourse analysis is not interested in particular lin-

177 Keller has published extensively in German (see, for instance, Keller et al. 2005; 2011; Keller 2008; 2011), but this thesis will only reference his useful discourse analysis textbook in English (Keller 2013).

guistic peculiarities (Keller 2013, 2). Another specificity is that discourse analysis is primordially invested with "naturally" obtained documents; this means that the data should be already available and not generated in the course of research (Hughes and Sharrock 2007, 328; Taylor 2013, 59–60). The choice of print media diminishes the risk of transforming the research object through interaction, as it exists for example in interviews (Mautner 2008, 32).[178] Moreover, the fact that the texts in question have already been published signifies that they have gone through a process of scientific and political evaluation and, eventually, approval. Mautner writes that this selection process is always "conditioned by economic, political, cultural and social structures." Nonetheless, these structures are obscured in everyday life which makes the results look completely "unbiased." Discourse analysis reveals the conditions that brought the texts into being and thereby discloses their situated character (Mautner 2008, 33–34).

4.2 Applied methods

In the following section, the concrete methods of this thesis are demonstrated. The ulterior motives for explicating the whole process in detail are, on the one hand, to be as methodologically transparent as possible, and, on the other hand, to assist students in performing their own studies.[179]

4.2.1 Self-reflection

One decisive insight of discourse theory is that there is no place outside of a discourse, no external, objective viewpoint for a scholarly investigation. Science is a discourse, as well (Hajer 1995, 49). The researcher is influenced by dominant discourse and will contribute either to its hegemony by reproducing it, or they will add to a competing discourse.[180] In any case, they are inescapably embedded in a relationship with discourse. In order to be intelligible, it is hence essential to be transparent and accountable in the methodological procedure. This means documenting, explicating, and legitimizing the choices of data, the applied codes and concepts, the instruments of analysis, the problems encountered in the process, and so on. In a nutshell: it means to be self-reflective (Mautner 2008, 37). Self-reflection equally includes laying out the reasons for choosing a specific discourse and research topic in the first place. The position and interests of the researcher necessarily influence any discourse analysis they undertake. In this thesis, the motivation and positioning of the author are demonstrated in the introductory chapter.

4.2.2 Sample

178 Yet, for sociology, a discourse encompasses not only discursive practices like texts, but also non-discursive practices (for example, slaughter) and materializations (say, slaughterhouses). Altogether, these elements form a *dispositive* (Jäger and Maier 2013, 170). In this thesis, however, the focus is on discursive practices.

179 Another useful instruction can be found in Methmann and Oels 2015.

180 In allyship with trans and gender-nonconforming identities, the thesis applies the gender-neutral pronoun "they."

4.2.2.1 Choice of data and access

The specificity of discourse analysis is that not just one single document, but a multitude of texts and their historic and sociopolitical context are scrutinized (Jäger and Maier 2013, 169). However, a complete discourse analysis does not require an endless amount of data. The researcher collects fragments until they perceive repetitions in the arguments of these texts. The discourse is then completely "saturated," to apply the jargon of discourse analysis (Keller 2013, 100).

One challenge in the sampling procedure of this project was to clearly frame the discourse of the Livestock Revolution and to close it off from neighboring discourses, such as the environmental consequences of the livestock industry, which is a burgeoning field of study. The selection criteria are explicated in the following paragraphs. The data can roughly be split in two groups. The first group consists of documents discussing the Livestock Revolution; thus, its content was decisive. The second group of data has been selected solely on the basis of authorship: the multi-stakeholder partnership "Global Agenda for Sustainable Livestock." A list of the entire sample, comprehending virtually one hundred texts, is provided in appendix 1.

4.2.2.1.1 Documents on the Livestock Revolution

Throughout the years 2014, 2015, and 2016, key publications on the "Livestock Revolution" have been searched in a cyclical sampling process. The conditions for including a document in the sample were that it was: published in English; publicly available online; contained the keywords "Livestock Revolution" in the title or body of the text; authored by international institutions such as the Food and Agriculture Organization of the United Nations (FAO), the International Food Policy Research Institute (IFPRI) or the International Livestock Research Institute (ILRI), the reasons for which will be explicated below, and/or of international scope and significance. The goal was to systematically assess and cover the *whole* discourse until saturation, as described above. This included Google searches with the keywords "livestock revolution."[181] The discourse fragments examined here lead to more results, following the trail of their references. In order to situate the fragments, their authors are indicated throughout the analysis. The timeframe of this sample stretches from the first recorded mention of the Livestock Revolution

181 FAO publications retrievable online were explored in a more targeted manner: Both the FAO publication section (http://www.fao.org/publications/en/ accessed June 7, 2016) and the FAO online Document Repository (http://www.fao.org/documents/en/ accessed June 7, 2016) have been examined. An additional search has been carried out in the publications of the FAO Division "Agriculture and Consumer Protection Department" (http://www.fao.org/ag/againfo/resources/en/publications.html accessed June 7, 2016) comprising the sections "Animal Production," "Animal Health," "Animal Welfare," "Environment," "Feed and Food Safety," and "Sector Analysis and Policy." The "Sector Analysis and Policy" section included the FAO "Livestock Policy Briefs" 2005-2008; and the Pro-Poor Livestock Policy Initiative Policy Briefs. The Document Repository has been searched with the keyword "livestock revolution." Further, English publications within the concept "livestock" have been searched.

in 1999 until today, a period of seventeen years. To gain an understanding of the material assessed here, the thesis will now turn to an explication of the most important documents.

The very central document of the Livestock Revolution discourse is the original Livestock Revolution report from 1999, henceforth called the "Revolution report" (Delgado et al. 1999).[182] It was authored by agricultural economists of the International Food Policy Research Institute, the Food and Agriculture Organization of the United Nations, and the International Livestock Research Institute. The authors from the International Food Policy Research Institute were the senior research fellows Christopher Delgado and Mark Rosegrant and the research analyst Claude Courbois. The FAO was represented by Henning Steinfeld, then senior officer for livestock development planning, and later promoted to Chief of Livestock Information, Sector Analysis and Policy Branch at the FAO headquarters in Rome. Simeon Ehui was the coordinator of the Livestock Policy Analysis Project at the International Livestock Research Institute (Delgado et al. 1999, 72). Before its publication, the report was reviewed and commented on by experts at the World Bank, the International Rice Research Institute, the World Food Prize Office, and Natural Resources International (UK) (Delgado et al. 1999, viii).

Though the Revolution report is unique for its breadth and impact, it only marked the beginning of the Livestock Revolution discourse. Numerous publications from FAO, ILRI or IFPRI researchers, as well as independent authors and two conferences (Brown 2003; Owen et al. 2004) debated the Livestock Revolution. These publications either support or criticize the Revolution on different grounds. Moreover, some of them have complemented the projections of the initial 1999 report through 2020 by forecasts through 2050 but do still call this evolution "Livestock Revolution." In these cases, the discourse analysis in chapter five indicates that the prognoses are through 2050.

Significant fragments are the "Livestock Policy Briefs" on the Livestock Revolution by the Livestock Information, Sector Analysis and Policy Branch of the Animal Production and Health Division (AGAL) of the FAO.

The International Livestock Research Institute continued its discussion of the Revolution, most importantly in the strategy reports "Making the Livestock Revolution Work for the Poor" (ILRI

182 Delgado, Christopher, Mark Rosegrant, Henning Steinfeld, Simeon Ehui, and Claude Courbois. (2011) 1999. "Livestock to 2020: The Next Food Revolution: Food, Agriculture, and the Environment Discussion Paper 28." Unpublished manuscript, last modified March 24, 2011. A summary of this report has been issued as Delgado, Christopher, Mark Rosegrant, Henning Steinfeld, Simeon Ehui, and Claude Courbois. 2000. *The coming livestock revolution.* Background Paper 6. New York: FAO. Background Paper No. 6. UN Department of Economic and Social Affairs; Commission on Sustainable Development, Eight Session, 24 April - 5 May 2000, New York. A shortened and slightly updated version of the Report is "Livestock to 2020: The Revolution Continues" (Delgado, Rosegrant, and Meijer 2001).

2000a; 2000b) and "Livestock—a pathway out of poverty" (ILRI 2002).[183] The focus of the International Livestock Research Institute clearly is the importance of livestock for smallholders (Hall, Ehui, and Delgado 2004; Jabbar 2004; Wright et al. 2012). Subsequently, the International Food Policy Research Institute coins the term "livestock industrialization" (Delgado and Narrod 2002; Delgado, Narrod, and Tiongco 2008) and continues its research on the future of the livestock sector (Narrod, Tiongco, and Scott 2011).

Noteworthy in the discourse of the Livestock Revolution are the recurring authors. Though the previously mentioned international institutions are of considerable size, a handful of male livestock economists dominate the debate, as will become apparent in chapter five. The contact person for the FAO "Livestock Policy Briefs" series was Henning Steinfeld. Senior Livestock Policy Officer Pierre Gerber was responsible for the first brief of 2005 (FAO 2005, 8). In 2008, Joachim Otte was the Coordinator of the FAO's Pro-Poor Livestock Policy Initiative and responsible for the 2008 brief on "Livestock Policy and Poverty Reduction" (FAO 2008, 8). In addition, there is livestock economist Achilles Costales of the Pro-Poor Livestock Policy Initiative of the FAO, Philipp K. Thornton as well as Mario Herrero from the International Livestock Research Institute; and Christopher Delgado and Mark Rosegrant from the International Food Policy Research Institute.[184] Costales, Gerber, and Steinfeld deliver an exceptional assessment of the structures "underneath the Livestock Revolution" (Costales, Gerber, and Steinfeld 2006). Steinfeld writes about the Revolution as a "global veterinary mission" (Steinfeld 2004). Steinfeld and Chilonda debate the Revolution's "old and new players" (Steinfeld and Chilonda 2006). Ugo Pica-Ciamarra and above-mentioned Joachim Otte from the FAO's Pro-Poor Livestock Policy Initiative scrutinize the "Rhetoric and Reality" of the Livestock Revolution. Pica-Ciamarra and FAO colleagues examine livestock in the household-economy (Pica-Ciamarra et al. 2015) and the significance of breeding programs (Hammond 2000). Jeroen Dijkman equally belongs to the Pro-Poor Livestock Policy Initiative when he expounds on the "elusive livestock revolution" (Dijkman 2009).

The highly influential FAO publication on the environmental impact of the livestock industry, *Livestock's Long Shadow: Environmental Issues and Options*, by Henning Steinfeld, Pierre Gerber, Tom Wassenaar, Vincent Castel, Mauricio Rosales, and Cees de Haan (henceforth Steinfeld et al. 2006 or *Livestock's Long Shadow)*, also discusses the Livestock Revolution (Steinfeld et al. 2006, 16). *Livestock's Long Shadow* is a milestone in the discourse on the ecological hoofprint and was cited in numerous studies on the matter. Its follow-up study from 2013, *Tackling*

183 Further reports include AGTR 2011; Blümmel et al. 2013; Pinstrup-Andersen, Pandya-Lorch, and Rosegrant 1999; Vercoe, Fitzhugh, and Kaufmann 2000.

184 The authors' positions listed here refer to period of the corresponding texts' original publications; they do not necessarily reflect these authors' current positions or employment.

Climate Change Through Livestock: A Global Assessment of Emissions and Mitigation Opportunities by Pierre Gerber, Henning Steinfeld, Benjamin Henderson, Anne Mottet, Carolyn Opio, Jeroen Dijkman, Alessandra Falcucci, and Giuseppe Tempio (hereafter Gerber et al. 2013 or *Tackling Climate Change*), has been added to the sample, as well, although it does not apply the term "Livestock Revolution." Both studies not only represent the problem of the ecological hoofprint, they propose solutions to it while also increasing productivity. A number of non-FAO papers deal with the environmental repercussions of the sector, too, for instance Barrett 2001.

The World Bank suggests policies and technologies to "Manage the Livestock Revolution" (World Bank 2005). The text, co-authored by livestock specialist Cees de Haan, is based on studies by Christopher Delgado and his colleagues at the International Food Policy Research Institute and the International Livestock Research Institute. Farrell (2002) declares a "Poultry Revolution" spearheading the Livestock Revolution. (Poor) smallholders are another concentration of publications dealing with the Livestock Revolution (among others, Heffernan 2004) and their intensification (Udo et al. 2011). Several publications are dedicated to biotechnology's role in the Livestock Revolution, in particular in "developing countries" (Hoffmann 2005; McCrabb et al. 2005; Onteru, Ampaire, and Rothschild 2010; Rothschild and Plastow 2014).

A number of publications focus on the impact of the Livestock Revolution in the Majority World, concentrating on Africa, Asia, and to a lesser degree on Latin America (Nicholson and Parsons 2012), with case studies on the Philippines, India, or Egypt. Li 2004, Li et al. 2008, Rae 2008, Rae and Zhang 2009, and Waldron et al. 2007 analyze the Livestock Revolution in China.

Critical in-depth accounts of the Revolution include Fritz 2014, Smil 2002 or York and Gossard 2004. Rivera-Ferre (2009) questions the argument that the Revolution is "demand-driven." MacLachlan studies the "Evolution of a Revolution" (2015). The working paper "Revolution Reconsidered: Evolving Perspectives on Livestock Production and Consumption" by Sumberg and Thompson (2013), published by the STEPS Centre in Brighton (UK), a global research and policy center, offers a precious analysis of the evolution of the notion. Deutsch, Lannerstad, and Ran from the Stockholm Resilience Center write on "Responsible Environmental Choices for a Sustainable 'Livestock Revolution'" (Deutsch, Lannerstad, and Ran 2011).

Finally, two notable publications were issued by animal rights or animal welfare organizations: A Well-Fed World calls to "Reverse the 'Livestock Revolution'" (AWFW 2016). Garcés from the Compassion in World Farming Trust studies the impact of factory farming on farmers and animals in the Majority World (Garcés 2002).[185]

185 The organization presents itself as a research-based farm animal welfare organization.

4.2.2.1.2 Documents by the Global Agenda for Sustainable Livestock

The term "Livestock Revolution" entered the discursive stage in 1999, and its message was here to stay. More than fifteen years after its first appearance, the stated need to almost double meat production appears unchallenged. In this period of time, partnerships and strategies were launched to sustainably intensify the sector and meet production goals. One core partnership is the "Global Agenda for Sustainable Livestock" (hereafter abbreviated as the "Global Agenda"). This multi-stakeholder partnership unites the public and private sector, academia, donors, non-governmental and inter-governmental organizations, and social movements (Global Agenda for Sustainable Livestock 2015a, 7–8). The Global Agenda does not only stand for policy research, but also for policy action. It makes use of the discourse of the Livestock Revolution—although without using the term itself[186]—and shows pathways to achieve it. In addition, the Agenda was initiated by the FAO as a direct result of a recommendation of the FAO's Committee on Agriculture, and to date, the FAO is the convener, programmatic collaborator, and secretariat of the Global Agenda (which will be elaborated in detail below). This is why documents issued by the Global Agenda have been added to the sample as a second group. The selection of the Global Agenda for Sustainable Livestock as one contemporary and active policy example was constantly reassessed throughout this study. The Agenda's growth and development, its engagement in the UN sustainable development discourse, and its relative prominence within the FAO justified an ongoing analysis of the multi-stakeholder forum.

The cyclical sampling process dated from 2014 through December 2016. The data gathered on the Agenda includes their homepage content, Action Plans, Welcome Letter, The Agenda Consensus, Good Practices Guidelines, key messages, and the presentation of their partners. All the Global Agenda material was publicly retrievable online. The Agenda's publications date back to 2013 with its first strategy document[187] and end with news announcements from December 2016 (Global Agenda for Sustainable Livestock 2016d).

4.2.2.2 Actors in the discourse

The presentation of the most important actors in the discursive field is a constituent of the detailed discourse analysis introduced in the next section. It provides background on the significance of the discourse, its scope and reach, and the interests at stake. The following provides a

186 In fact, no contemporary international multi-stakeholder initiative applies the term.

187 Back then, the Global Agenda was called "Global Agenda of Action in support of sustainable livestock sector development."

short background of the FAO and the Global Agenda for Sustainable Livestock. The focus here is on the FAO and not the International Food Policy Research Institute or the International Livestock Research Institute for three reasons. First, the International Food Policy Research Institute, based in Washington DC, and the International Livestock Research Institute, based in Nairobi, are two single research centers, associates of the CGIAR Consortium, a "worldwide partnership engaged in agricultural research for development" (IFPRI 2016). The FAO, on the other hand, is the main international institution and authority for food and agriculture as a whole. It has a much wider scope and enjoys wide international recognition and significance and thus so do its publications. Second, the focus of this thesis is on the environmental sustainability of the livestock sector and on how the Revolution should be achieved given its massive need for limited resources. The FAO has issued two primordial reports on the issue. Finally, the International Livestock Research Institute is also a member of the Global Agenda of Sustainable Livestock and thus indirectly part of the second sample.

4.2.2.2.1 FAO

Like all large intergovernmental organizations, the Food and Agriculture Organization of the United Nations can seem to be a rather opaque institution. It is helpful to take a look behind the scenes to understand the impact of its policy recommendations.[188] The agency had its first session in 1945 (FAO 2016a).[189] Today, it consists of 194 Member Nations, two Associate Members and the European Union as one member organization (FAO 2016d). These members have very diverse interests which can lead to contradictory perspectives on specific problems, including ambiguous livestock policy recommendations—those ambivalences will occupy center stage in the fifth chapter.[190] Each Member Nation and Associate Member is represented by one delegate. Its Conference meets biennially and elects Council Members and the Director-General.[191] The FAO offices identify and implement actions and assist governments in food and agriculture policies and projects (FAO 2016d).[192] The FAO's three main goals are

> "the eradication of hunger, food insecurity and malnutrition; the elimination of poverty and the driving forward of economic and social progress for all; and, the sustainable manage-

188 No claim is being made here to completely cover or to do justice to the complexity of this UN agency.

189 For a detailed history of the FAO compare Small and O'Broin 2015.

190 There are not only inconsistencies within the FAO. Other institutions of the United Nations, such as the United Nations Conference on Trade and Development (UNCTAD) or the United Nations Environment Programme (UNEP), advocate for a decrease in production and consumption, in contrast to the FAO's appeal to double meat production (Emel and Neo 2015, 2; Westhoek et al. 2016). Nevertheless, the scope of this thesis does not allow for a deeper analysis of this subject.

191 Since 2012, the FAO's Director-General is José Graziano da Silva of Brazil (FAO 2016d).

192 Employing more than 3,000 permanent staff members, the FAO's network comprises five regional offices, nine sub-regional offices, 80 country offices, and other decentralized offices, and is headquartered in Rome, Italy. The total budget 2016/17 amounts to 2.6 billion USD. 61 percent of the budget stems from voluntary contributions of Members and other partners, 39 percent stem from assessed contributions by the member countries (FAO 2016b). The value of programs and projects implemented in 2014/2015 was 1.6 billion USD, mainly funded through voluntary contributions (FAO 2016d).

ment and utilization of natural resources, including land, water, air, climate and genetic resources for the benefit of present and future generations." (FAO 2016a).[193]

Special attention is dedicated to the FAO's Committee on Agriculture (COAG). As one of the eight Committees assisting the FAO Council, the Committee on Agriculture is the FAO's "main technical advisory committee on agriculture" (FAO 2016e).[194] It advises the FAO Council, Conference, and Director General in all matters relating to agriculture, livestock, agricultural policy, food, nutrition, and resource management, and suggests pathways for concerted action (FAO 2016e). The COAG was founded in 1971 and remains an "important forum for informed and strategic discussion" to this day. The Committee's advice to the Council to foster the development of the seed industry only incrementally offset the effects of the Green Revolution of the 1970s, a fact that leads the Committee itself to speak of its own "quiet power and influence" (COAG FAO 2014).[195] The promotion of "cleaner, greener agriculture" is a top item on the Committee's agenda. Highlighting the positive importance of agribusiness and agro-industries for food security and rural employment was the goal of a COAG 2007 recommendation (COAG FAO 2014). Recognizing the vitality of sustainable agriculture, the Committee further contributed to the preparatory process of the Rio+20 Conference, and assisted in developing the "Climate Smart Agriculture Alliance," the initiative "Greening the Economy with Agriculture," or the "Save and Grow Initiative" (see section 3.4.4).[196]

The COAG had already taken up the issue of future livestock production and sustainability in 2005. In 2010, it recommended the FAO tackle the issue. The multi-stakeholder partnership Global Agenda for Sustainable Livestock was thereafter created and endorsed by the Committee in 2012 (COAG FAO 2014). At its twenty-fifth Session in September 2016, the Committee discussed the governance structure of the Global Agenda for Sustainable Livestock and called for an even greater engagement of the FAO (FAO 2016h). Next to being an intergovernmental stakeholder, the FAO is the convener, programmatic collaborator, and secretariat of the Global Agenda, providing administrative and operational support (COAG FAO 2016, 6). The important role of the Global Agenda in fostering the sustainable development of the livestock sector is additionally emphasized in the FAO report *Tackling Climate Change* (Gerber et al. 2013, 101).

193 The FAO's strategic objectives are: 1) to "Help eliminate hunger, food insecurity and malnutrition; 2) to make agriculture, forestry, and fisheries more productive and sustainable; 3) to reduce rural poverty; 4) to enable inclusive and efficient agricultural and food systems; 5) to increase the resilience of livelihoods to threats and crises" (FAO 2016a).

194 The Committee, part of the Agriculture and Consumer Protection Department currently has 126 members and meets biennially (FAO 2016g).

195 The Committee still supports the development of seed systems all over the globe, defining good quality seeds as "certified" seeds. In 1999, it advised concentrating on biotechnology which led to the FAO's creation of the "Inter-Departmental Working Group on Biotechnology" (COAG FAO 2014).

196 Further areas of strategic relevance are gender equality in agriculture, soil governance, and water resources.

4.2.2.2.2 Global Agenda for Sustainable Livestock

"Sustainable livestock. For people, for the planet"
(Global Agenda for Sustainable Livestock 2014b, 14).

As described, the Global Agenda for Sustainable Livestock has been initiated by the FAO in 2010 and officially launched in 2013. It unites seven different clusters of sector stakeholders: the public and private sector, academia/research, donors, NGOs, social movements and community-based organizations, and inter-governmental and multi-lateral organizations, such as the World Bank or the FAO (Global Agenda for Sustainable Livestock 2015a, 7–8).[197] The Agenda analyzes, informs, networks, and provides guidance through voluntary guidelines and sector recommendations (Global Agenda of Action 2013, 4). It has developed several frameworks and tools to assess natural resource use efficiency, or to manage manure, among others (Global Agenda for Sustainable Livestock 2015a, 6). Nevertheless, the Agenda additionally "agrees on action" and is "geared towards practice and policy change" (Global Agenda for Sustainable Livestock 2015a, 1). In essence, the Agenda "acts as a platform to promote livestock sector investments" collaborating with governments, donors, investors, and development agencies (Global Agenda for Sustainable Livestock 2015a, 12). Its goals are to become the "leading multi-stakeholder platform" for sustainable livestock development (Global Agenda for Sustainable Livestock 2015a, 11), and "to become a key implementation process of the UN Agenda 2030 for Sustainable Development" (Global Agenda for Sustainable Livestock 2015a, 5).

Which actors are united in the Agenda? There is no straightforward way to find a list of the Agenda's current members. There are inconsistencies between the Agenda's homepage section

197 In more detail, the seven clusters are described as follows: "1. Public Sector—representatives from governments; 2. Private Sector—representatives from private sector organizations; 3. Academia/research—representatives from research organization and universities; 4. Donors—representatives from monetary contributors to the Agenda's Trust Fund; 5. NGOs—representatives from interest groups such as animals welfare and environmental or livelihood non-governmental organizations; 6. Social movements and community based organizations—representatives of pastoralists, indigenous people, agricultural workers, small farmers and peasants; 7. Inter-governmental and multi-lateral institutions—institutions that have a mandate in livestock sector development, e.g. World Bank, CGIAR, OIE, FAO, WHO, represented by the Livestock Global Alliance as appropriate" (Global Agenda for Sustainable Livestock 2015a, 28). The organizations join the Global Agenda by signing the consensus document (Global Agenda for Sustainable Livestock 2015a). Stakeholder commitment is voluntary; decisions are made by consensus (Global Agenda for Sustainable Livestock 2016b). The Global Agenda itself is a partner of the FAO's "Sustainable Food and Agriculture" Initiative. Other partners are the Commission on Genetic Resources for Food and Agriculture. Global Alliance for Climate-Smart Agriculture (CSA Alliance), the multi-partner program Energy-Smart Food for People and Climate (ESF), the Global Soil Partnership (GSP), and the REDD+ program (Reducing emissions from deforestation and forest degradation) (FAO 2016l). The Agenda's structure comprehends a Guiding Group with five representatives of every stakeholder group (cluster), three Focus Area groups, and a Technical Support Team. It has incubated several multi-stakeholder platform meetings, the regional technical networks "Dairy Asia-Network" and the "Global Network on Silvopastoral Systems (GNPSPS)." Likewise, the partnership has launched thematic initiatives on "Livestock Waste Management" and "Enteric Methane" (Global Agenda for Sustainable Livestock 2015a, 5). In the period from 2016-2018, the Agenda has a budget of 3.5 million USD, excluding Focus Areas and Knowledge Networks (Global Agenda for Sustainable Livestock 2015a, 3).

"Partners" and the Agenda's news announcements (Global Agenda for Sustainable Livestock 2016a; 2016d), declaring that the Agenda consisted of 82 members, and the web section "Partners" that listed 77 partner logos when last checked on December 30, 2016 (Global Agenda for Sustainable Livestock 2016f). The present count combines both information sources which results in a working total of 80 members. It is nowhere specified to which cluster a specific member pertains. Table 4 is a proposal to structure the members in clusters, and in their origins—stemming from either the Majority or Minority World as appropriate. In appendix 2, all the members are listed in detail. Despite its potential flaws,[198] the structure offers an overview of the diverse clusters and their respective weight in the Agenda. The goal of such a categorization is to test the Agenda's following claim:

> "The Agenda partnership addresses the multiple facets of sustainability simultaneously. Its inclusion of all key stakeholders contributes to a clear voice for each facet." (Global Agenda for Sustainable Livestock 2014a).

Moreover, in its Action Plan 2016-2018, the Agenda deplores a "lack of engagement and insufficient participation of developing countries and emerging economies" (Global Agenda for Sustainable Livestock 2015a, 15). This assertion should be examined, too.

Table 4: Members of the Global Agenda for Sustainable Livestock.

Cluster	**Total**	**Minority World**	**Majority World**
All clusters	*80*	*51*	*29*
1 Public sector	16	6	10
2 Private sector	16	15	1
3 Academia/research organizations	28	17	11
4 Donors	?	?	?
5 Non-governmental organizations	9	8	1
6 Social movements and community-based organizations	4	1	3
7 Inter-governmental and multi-lateral organizations	7	4	3

Following this categorization, the majority of Agenda members are academic/research organizations (35 percent). The next two largest groups are governmental representatives and representatives from private sector organizations (both 20 percent). Fourth is non-governmental organizations (eleven percent), and the fifth group consists of inter-governmental and multi-lateral organizations (nine percent). Social movements are the weakest group (five percent). No donor can

198 The structuring is a putative one, and the lines between the cluster academia/research, NGOs, and social movements are blurred. Consequently, the structure must be taken with a grain of salt.

be identified online, however, as several members appear to not be represented on the homepage, the unidentified members might be donors.

29 of 80 members are based in the Majority World. This equals 36 percent.[199] The partners from the Majority World are mainly research institutions (11 of 29) and governmental organizations (10 of 29). The governments involved are Germany, France, Ireland, New Zealand, The Netherlands, Switzerland, the Dominican Republic, Rwanda, Panama, El Salvador, Uganda, Kenya, Costa Rica, Cuba, Ethiopia, and Paraguay. Hence, primarily Europe and Latin America are represented; Asian, and, to a lesser degree, African countries are underrepresented.

The private sector group includes powerful lobby organizations such as the International Meat Secretariat, France, the International Dairy Federation, Belgium, the International Poultry Council, United States, the International Egg Commission, United Kingdom, and the International Feed Industry Federation, Germany/Luxemburg. The Agenda explicitly "builds on the expertise and entrepreneurial skills of the private sector in an alliance with the public sector and other stakeholders" (Global Agenda of Action 2013, 4). Likewise, it promises the private sector "new business and livelihood opportunities" obtained from the Agenda (Global Agenda of Action 2013, 4). It is notable that with one exception, all the sixteen lobby organizations are based in the Minority World.

In general, it appears that the industry's stakeholders—especially those from the private sector—engage in various networks. To elucidate, the executive committee of the Agenda member Global Roundtable for Sustainable Beef, a private sector group based in The Netherlands and the United States, has a representative of the Canadian Cattlemen's Association for president. Its Vice President is a representative of the World Wildlife Fund, the Secretary-Treasurer is from Elanco, and the two "members at large" are representatives of McDonald's Corporation and JBS, USA. The Canadian Cattlemen's Association and the World Wildlife Fund are members of the Agenda as well. Another example is the Agenda member LIFLOD, the Livestock Farming and Local Development Network, uniting stakeholders like researchers, farmers, and development agencies, which are, again, almost exclusively Global Agenda partners.

The NGO partners, nine in total, include four animal welfare groups, four environmental groups, and one human rights group (see appendix 2). Social movements are even more underrepresented with five representatives. Going back to the Agenda's assertion that it included "all key stakeholders," and that "each facet" of sustainability had a "clear voice," the

199 In September 2016, this was still at 31 percent, not even a third. At that time, there were almost as many Minority World lobbies (22 percent) as members from the Majority World (31 percent).

detailed membership directory suggests that governments, research institutions, and the private sector are the principal voices and that the economy constitutes the main facet of the Agenda.

4.2.2.2.3 Self-positioning of the actors

In the publications, the FAO reports and the Global Agenda present themselves as the ones who bring about change through knowledge creation, policy recommendations, and networking. The FAO portrays itself as creating and distributing knowledge and sharing policy expertise. It is a "neutral forum" that forges dialogue between "rich and poor nations" and fosters public-private collaboration (FAO 2016d). In addition, the FAO Rome headquarters is a place where "world leaders have discussed food issues and made groundbreaking decisions for global food security" (FAO 2016c). The slideshow on the Global Agenda's homepage, on the other hand, claims that "[t]he Agenda builds consensus on the path towards sustainability" (Global Agenda for Sustainable Livestock 2016c). Both FAO and Global Agenda posit themselves as crucial players in the "sustainable development" of the sector, and are noticeably committed to remaining optimistic in a rather desperate situation.[200] To illustrate further, the FAO report *Tackling Climate Change* introduces its findings by stressing that this

> "new report shows that the potential to significantly reduce emissions exists and is within reach. Options are available for all species, systems and regions. But we need political will and better policies" (Gerber et al. 2013, ix).

Fraser, Chair of the Guiding Group of the Global Agenda in 2014, boldly states:

> "I believe this initiative represents a collective 'force for good' that responds to a global need by simultaneously addressing the social, economic and environmental performance of livestock systems" (Global Agenda for Sustainable Livestock 2015b).

4.2.3 Instruments of analysis and of interpretation

The present study relies on Keller's accessible instructions while complementing them with Hajer's "argumentative approach." Among others, the term "argumentative" serves to show how actors in a discourse try to convince the public of their definition of the problem (Hajer 1995, 53–54). According to Keller, any investigation should include, first, a detailed analysis of each

200 For instance, the Global Agenda defines itself as "a partnership of livestock sector stakeholders committed to the sustainable development of the sector." (Global Agenda for Sustainable Livestock 2016b).

discourse fragment (which means, each text), comprising, next to a scrutiny of its content, one of its form, rhetorical means, and other peculiarities. Second, a structural, overarching analysis of the discourse is needed encompassing all fragments (Keller 2013). This holistic picture is painted in chapter five. In addition, a quantitative assessment of the three discourse fragments Revolution report (Delgado et al. 1999), *Tackling Climate Change* (Gerber et al. 2013), and the Global Agenda Action Plan (Global Agenda for Sustainable Livestock 2015a) is brought forward in appendix 3. Though not representative for the whole discourse, it illustrates the changing use of terms like "nature," "efficiency," and "poverty."

4.2.3.1 Detailed analysis

The first, detailed analysis of each fragment examines, first, the context of the fragment. This context comprises its authors, which, in most cases of the present analysis, were representatives of the FAO and the Global Agenda (see above); the addressed public, which mainly is an informed group of sector stakeholders; and the bigger socio-historic and economic context. This context has been laid out in depth in chapter two. Second, a detailed analysis targets the formal or rhetorical structure of the document in question. It asks whether the paper is, for instance, of scientific, educational, entertaining, or political nature. The language and layout of the document are equally studied. The documents examined here are primarily research papers and studies, and policy documents with sector recommendations. Their layout may differ, but they are similar in rhetorical structure and style. Generally, the tone is sober, technical, and apparently impartial. Nonetheless, optimistic and pessimistic undertones repeatedly appear in the studies. This will be exemplified in more detail in chapter five. Third, and most importantly, the detailed analysis contains an analytical reconstruction of the document's content, exposing its so-called "problem structure" or "phenomenal structure." In this central part, the structure and dimension of the problem is re- or deconstructed. Seemingly "neutral" statements are put in context and contrasted with the actors' positions and reference values.

Following Keller's guidelines and categories (Keller 2013, 115–21), all the discourse fragments have been coded and investigated. The codes that emerged in the analysis and the reasons behind them are then explained. The categories and codes consisted of: the *causes* of a certain problem (in the case of the ecological hoofprint, codes in this category were inefficiency or the animals' digestion); the *assignment of responsibility* to somebody or something (codes included, for example, blaming small livestock farmers or legislation); presenting *solutions* to the issue (intensification); *self-positioning* in the field (for instance, comparing the FAO and the Global Agenda's self-representation mentioned above); *positioning of others* and their suggestions; and finally, the *reference values* of the actors. Such reference values included, among others, the assigned value of nature or the definition of "progress." On many occasions, the statements in the

texts, taken together, generated a portrait of ecological modernization. This last category has been the most difficult to assess. Its interpretation was facilitated through comparing and contrasting various representations of the problem structure and the proposed solutions, and a constant process of evaluating and re-evaluating the documents. This movement further required taking into account the development and history of the animal-industrial complex as elaborated in chapter two, a consideration of the socio-historic and economic context, and the continuous remembrance of the contingency of things.

Out of this detailed analysis, storylines emerge in the discourse (Keller 2013, 124–27). Essentially, storylines reduce the complexity of a certain problem (similar to a metaphor) and order understandings (Hajer 1995, 56). While reducing fragmentation, they close the discourse, as well. Their power is constituted by the feeling that "it sounds right," which encompasses not only plausibility but also trust and acceptability (Hajer 1995, 62–63). Chapter five features the most important storylines such as "The Livestock Revolution is a natural and inevitable event in the course of progress," "The Revolution can be furthered with intensification and green growth," and "Animal production contributes to food security, to the livelihoods of the poor, and to environmental sustainability."

It was not possible to apply these ready-made categories to *every* discourse fragment. At times, a category was not to be found, and another category was very prominent in turn. Nevertheless, as a first step every fragment has been scrutinized according to the categories. Another challenge in the detailed analysis was the interdisciplinary nature of the discourse. Reports from such diverse fields as Earth sciences, agronomics, veterinary science, or political economy were consulted and assessed.[201] The scrutiny of these reports demanded acquiring basic knowledge in each field.

4.2.3.2 Structural analysis

Keller suggests complementing the first, detailed analysis by a second, diachronic structural analysis (Keller 2013). Such structural analysis provides a holistic picture of the discourse. Here, every discourse fragment is contextualized within the whole discourse. The full picture of the structure of the discourse is only retrievable at the end of the detailed analysis of all discourse fragments. The structural analysis investigates whether a specific fragment constitutes a novelty or a repetition in the discourse. By analyzing the discourse's structure along with the emerging storylines, discourse coalitions appear. Discourse coalitions are formed by different actors who adhere to certain storylines. This means that discourse coalitions are not necessarily based on shared interests but rather on shared storylines (Hajer 1995, 65). In the present case,

201 This is a general problem of analyzing environmental discourse, because it comprehends discourses from the natural as well as from the social sciences (Hajer 1995, 45).

the FAO, the International Food Policy Research Institute, the International Livestock Research Institute and the Global Agenda for Sustainable Livestock enter into one discourse coalition. These actors do not necessarily further the exact same agenda, nonetheless, they all refer to the same storylines. The fact that the discourse overall features only one discourse coalitions shows how uniform and universal the storylines function, and how minimal the objections against the Revolution are.

The goal of the second chapter was to provide an in-depth analysis of the past, present and future of the animal-industrial complex, and its effects on the farmed animals, the environment, and society at large. As previously stated, discourse analysis differs from mere textual analysis in its comprehension of those socio-historic, economic, and political conditions that have been produced and reproduced by the discourse. These conditions pertain to the structural analysis as well. For example, the storyline that the Livestock Revolution contributed to food security "sounded right" in the decades where grain prices were low. This, however, drastically changed with the food crisis of 2008. Now, the same storyline sounds odd at best. In the production and reproduction of material reality through this discourse, special attention was dedicated to the intersection of animal exploitation, social discrimination, and environmental degradation. The storylines have, in a final step, brought about the mirror move of capitalizing on/controlling nature and naturalizing capitalism/control, elaborated in the third, theoretical chapter. This mirroring lens of analysis divides chapter five into two parts and embeds it in a wider societal critique.

The overall process of the detailed and structural analysis, starting from the analytical reconstruction of the problem structure with codes and categories, is illustrated in figure 8.

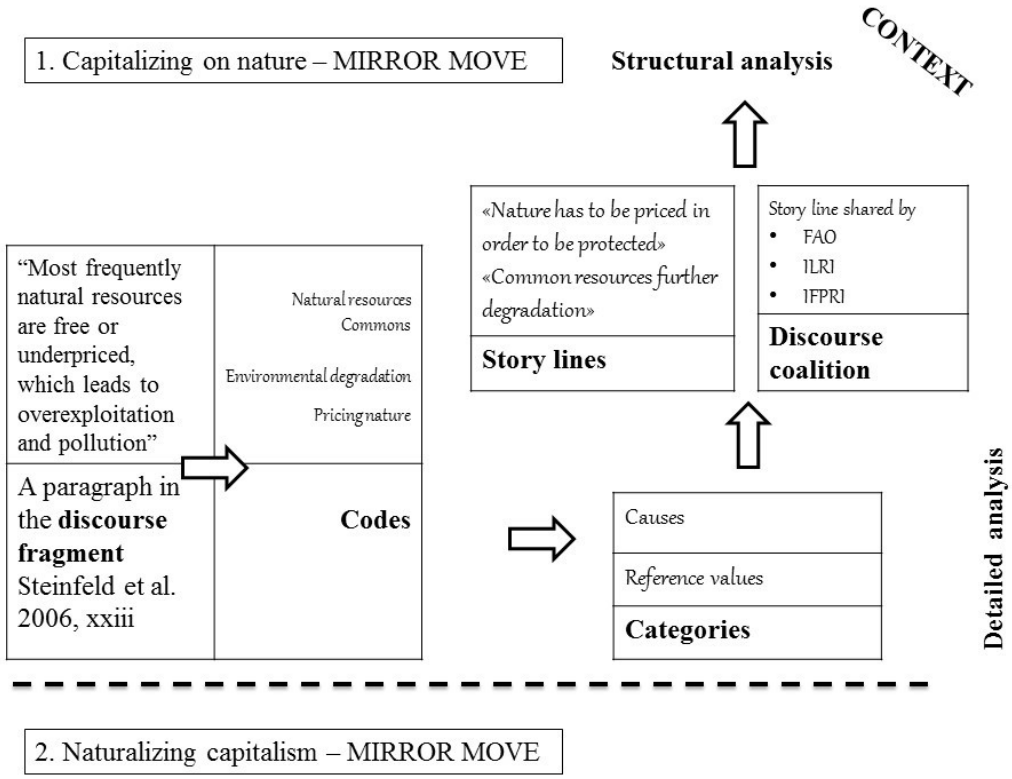

Figure 8: Illustration of detailed and structural analysis.

PART III

5 DISCOURSE ANALYSIS: THE LIVESTOCK REVOLUTION AS SUSTAINABLE EXPLOITATION

In essence, the Livestock Revolution is an increase of 70 percent in the demand for animal products by 2020, caused by increasing disposable income, population growth, and urbanization. As stated previously, this demand is mainly propelled by the Majority World, which adds to its world-shattering aura (Delgado et al. 1999, 1), and it will presumably be met by industrial systems that are providing 80 percent of total sector growth (Steinfeld et al. 2006, 278).[202]

This chapter is dedicated to an analysis of the discourse of the Livestock Revolution. Chapter four elaborated the methodological approach, whereas chapter two on the animal-industrial complex provided the socio-economic basis for the investigation. Chapter three established the theoretical background and foil against which the analysis is performed. The analysis in the present chapter is structured in two parts: part A covers elements of the capitalization and control of nature, and part B features storylines of the naturalization of control and capitalism.

As a whole, the discourse analysis here follows the problem structure of the discourse and carves out its storylines and discourse coalitions. First, it examines the Livestock Revolution's rhetoric (5.1). Second, it defines the problem, the Livestock Revolution, according to its key actors, its authors (5.2). The Revolution is presented in quantitative terms by asking the following questions: What will the concrete growth in the sector look like? What share exactly will the Majority World have in the sector? Third, the reasons for the Revolution are elucidated (5.3).

In part A (capitalization and control of nature), in section four (5.4), the responsibilities and the solution of the productivity increase and socio-economic and environmental challenges of the Revolution (sustainable intensification) are presented and contrasted with the move to capitalize on and control nature. The fifth section (5.5) is dedicated to the actual subjects of the debate, those who "embody" the Revolution: the farmed animals. It investigates their representation in the discourse and critically examines the intended effect of sustainable intensification: the sustainable exploitation of these animals. The sixth section (5.6) comprises an examination of demand and supply in the Revolution and concomitantly, a reflection on its contingency. It

202 As sketched in the methodological overview in chapter four, some studies have extended the projections of the initial 1999 report for 2020 by calculations for the year 2050 yet still refer to it as "Livestock Revolution."

thereby equally deconstructs the storylines of sections 5.3 and 5.4 (the reasons for and solutions of the Revolution). This section starts with a consideration of a possible reversal of the Revolution: if the animal-industrial sector is such a great challenge for the environment, why not encourage a reduction of the consumption of animal foods, at least in the Minority World, rather than its growth? The second subsection features an opposing account and shows how the Revolution is appraised. Third, the mutually exclusive binary of supply and demand is deconstructed. Subsections four and five examine the material, technological, and institutional conditions sustaining the Revolution, as well as who profits from it.

Part B of the analysis draws on the other side of the mirror move: the naturalization of control and capitalism (5.7). Here, eminent storylines and their underlying reference values are scrutinized. In addition, this analysis digs out the inconsistencies, contradictions and breaks in the Livestock Revolution discourse. First, the dietary shift towards more animal protein is said to be a sign of modernization. The second storyline is that it supposedly constitutes an opportunity, but also a risk, for smallholders. Third, the Revolution should guarantee food security, yet, due to its rising use of feed grain, it constitutes a threat. Finally, the Revolution is said to be of substantial importance for the environment—though a danger as well. Each of those justifications for the Revolution is juxtaposed with the detrimental effects the Revolution engenders. Essentially, the arguments as such are deconstructed as forms of naturalizing control and capitalism.

5.1 Revolutionary rhetoric

> "A revolution is taking place in global agriculture that has profound implications for our health, livelihoods, and environment. Population growth, urbanization, and income growth in developing countries are fueling a massive global increase in demand for food of animal origin." (Delgado et al. 1999, 1).[203]

The epic tone of this first sentence of the report introducing the Livestock Revolution bears resemblances to the beginning of the Communist Manifesto by Marx and Engels.[204] Yet, here, the specter haunting the world is not communism, but meat consumption. Applying such a revolutionary rhetoric is by no means a matter of chance. The discourse of modern agricultural development of the last five decades is dominated by the idea of "revolution." Among them are the influential Green Revolution of the 1960s,[205] the White and Pink Revolution, designating milk

203 The classification in developing and developed countries in the original Livestock Revolution report is as follows: the developed countries are "Australia, Canada, Eastern Europe, European Union, other Western European countries, Israel, former Soviet Union, Japan, New Zealand, South Africa, United States." The developing countries are "all other countries in FAO Statistics Database." (Delgado et al. 1999, 66).

204 "A specter is haunting Europe—the specter of communism."

205 For a critical account, see Jarosz 2012.

and beef production in India, the Blue Revolution in aquaculture,[206] or the Supermarket Revolution (which symbolized the spread of supermarkets in the Majority World which will be discussed in part 5.6) (Sumberg and Thompson 2013, 5). The term "revolution" conveys an image of an unprecedented, unforeseeable, and even dangerous, sudden change, both in scale and quality.[207] "Revolution" raises hopes, but also fears, and correspondingly, the threats and promises of the Revolution are a recurring theme in the discourse. The sundry elements of the Revolution offer "both dangers and positive opportunities for human welfare and environmental sustainability" (Delgado et al. 1999, 59).

The revolution is a powerful imaginary that enforces a rapid response. Talking about a "revolution" in fact furthers, even "makes" the revolution (Sumberg and Thompson 2013, 5–6). For Ehui, coordinator of the International Livestock Research Institute's Livestock Policy Analysis Program and co-author of the Livestock Revolution study, it is a "wake-up call" for action, and he adds: "It's happening, whether we like it or not. We can't just sit back and watch" (ILRI 2000a, 3–4). There is no possibility to alter course: The Livestock Revolution "is a given that must be dealt with," according to the report (Delgado et al. 1999, 3):

> "In sum, it is unwise to think that the Livestock Revolution will somehow go away in response to moral suasion by well-meaning development partners. It is a structural phenomenon that is here to stay. How bad or how good it will be for the populations of developing countries is intricately bound up with how countries choose to approach the Livestock Revolution." (Delgado et al. 1999, 65).

A revision of the Revolution report in 2001 confirms the "conservative" initial findings, stating "whether it is a good thing is not the issue; it is a phenomenon that will occur" (Delgado, Rosegrant, and Meijer 2001, 17). With a similar level of pathos, the authors introduce the Revolution as "one of the largest structural shifts to ever affect food markets in developing countries" (Delgado et al. 1999, 4). On the very first page of the Revolution document, it is defined as a challenge that "will stretch the capacity of existing production and distribution systems and exacerbate environmental and public health problems" (Delgado et al. 1999, 1). This expansion will be especially hazardous for the Majority World (Delgado et al. 1999, 9). In greater detail, the Revolution authors define seven characteristics:

> "(1) rapid worldwide increases in consumption and production of livestock products; (2) a major increase in the share of developing countries in total livestock production and con-

206 For more information on the Blue Revolution, see Rivera-Ferre 2009.

207 Twine observes how the term "revolution" has been stripped of any emancipatory content (Twine 2010, 161), which mirrors the eco-modernist discourse's appropriation of the transformative language of the environmental movement.

sumption; (3) ongoing change in the status of livestock production from a multipurpose activity with mostly nontradable output to food and feed production in the context of globally integrated markets; (4) increased substitution of meat and milk for grain in the human diet; (5) rapid rise in the use of cereal-based feeds; (6) greater stress put on grazing resources along with more land-intensive production closer to cities; and (7) the emergence of rapid technological change in livestock production and processing in industrial systems." (Delgado et al. 1999, 59).

5.2 The Revolution in numbers

The Livestock Revolution is said to have started in the 1980s and supposed to continue until the 2020s (Steinfeld et al. 2006, 16), accompanying the projected short- and long-term rise in income,[208] urbanization and population (Dijkman 2009, 3). As the Livestock Revolution focuses on demand, it makes projections of consumption trends.[209]

Table 5: "Past and projected trends in consumption of meat and milk in the Majority and Minority World."

208 Income has been growing since 1950 and is expected to grow in the future (Thornton 2010, 2854).

209 To determine the relationships between supply and demand for animal products and feed grain over time, the economists used the IMPACT model ("International Model for Policy Analysis of Agricultural Commodities and Trade") developed by the International Food Policy Research Institute (Delgado et al. 1999, 3, 21-23).

Year	Annual per capita consumption			
	Meat (kg)		Milk (kg)	
	Majority	Minority	Majority	Minority
1980	14	73	34	195
1990	18	80	38	200
2002	28	78	44	202
2015[210]	*32*	*83*	*55*	*203*
2030	*38*	*89*	*67*	*209*
2050	*44*	*94*	*78*	*216*
2050/1980	*+214%*	*+29%*	*+129%*	*+11%*

Year	Total consumption					
	Meat (Mt, million metric tons)		Milk (Mt)		Meat (Mt)	Milk (Mt)
	Majority	Minority	Majority	Minority	Total	Total
1980	47	86	114	228	133	342
1990	73	100	152	251		
2002	137	102	222	265		
2015	*184*	*112*	*323*	*273*	*296*	*487*
2030	*252*	*121*	*452*	*284*		
2050	*326*	*126*	*585*	*295*	*452*	*880*
2050/1980	*+594%*	*+47%*	*+413%*	*+29%*	*+240%*	*+157 %*

Note. Adapted from "Livestock production: recent trends, future prospects," by Philip K. Thornton, 2010, *Philosophical Transactions of the Royal Society B: Biological Sciences,* 365 (1554), p. 2854. Copyright 2010 by The Royal Society. Adapted and reprinted with permission. The data for 1990-2015 stems from Steinfeld et al. (2006) and for 2030-2050 from Alexandratos and Bruinsma (2006). Projections are shown in italics. The table differs slightly from the table 2 in section 2.1.2.3 adapted from Steinfeld and Chilonda (2006, 3).

Two tables adapted from Thornton (2010, 2854) show past and projected trends in meat and milk consumption, both for the Majority and Minority World from 1980 to 2050. The per capita as well as the total consumption of both meat and milk is projected to rise everywhere; however, the growth is much higher in the Majority World. There, annual per capita meat consumption

210 The per capita meat consumption in the Minority World in 2013 was 113 kilograms on Turtle Island, 114 kilograms in Australia and New Zealand, and 77 kilograms in Europe. The per capita milk consumption in the Minority World in 2013 was 248 kilograms on Turtle Island, 219 kilograms in Australia and New Zealand, and 215 kilograms in Europe (FAOSTAT 2017). The projected values of 83 kilograms of meat and 203 kilograms of milk on average might be rather conservative.
The per capita meat consumption in the Majority World in 2013 was 19 kilograms in Africa, 55 kilograms in Central America, 45 kilograms in the Caribbean, 81 kilograms in South America, 33 kilograms in Asia, 38 kilograms in Melanesia, 32 kilograms in Micronesia, and 102 kilograms in Polynesia (FAOSTAT 2017). The per capita milk consumption in the Majority World in 2013 was 44 kilograms in Africa, 105 kilograms in Central America, 70 ki-lograms in the Caribbean, 135 kilograms in South America, 60 kilograms in Asia, 39 kilograms in Melanesia, 11 kilograms in Micronesia, and 77 kilograms in Polynesia (FAOSTAT 2017).

triples from 1980 to 2050, and milk consumption doubles. Total consumption of meat surges seven-fold and total consumption of milk multiplies more than five-fold. The growth in the Minority World, on the other hand, does not surpass 50 percent in any category. Nevertheless, as massive the upsurge in the Majority World is, the per capita consumption of animal products is still three times as large in the Minority World as in the Majority World.[211] To keep up with this demand, global meat production is expected to proliferate from 229 million tons in 1999/2001 to 465 million tons in 2050; global milk production is anticipated to almost double from 580 to 1,043 million tons (Steinfeld et al. 2006, 275).

As shown, demand is stagnating in the Minority World (see the next section) (Steinfeld 2004, 20). Still, even in the Majority World demand is not distributed equally, and not consistent for all livestock species. Half of the growth rate Delgado et al. projected in 1999 is due to growth in China (FAO 2011b, 5). Consumption in urban areas is growing significantly more than in rural areas (FAO 2011b, vi). As for species-specific growth, monogastric livestock like poultry and pigs clearly account for the bulk of expansion (Delgado et al. 2000, 6). More specifically, the Livestock Revolution is said to be "spearheaded by the Poultry Revolution" (Farrell 2002, 1). For instance, demand in poultry meat in South Asia is expected to grow by 850 percent until 2030 (FAO 2011b, viii). Per capita production growth for ruminants, on the other hand, is described as stagnating (FAO 2013, 142).[212]

5.3 Reasons for the Revolution

Unlike previous revolutions, such as the Green Revolution, the Livestock Revolution is said to be demand-driven, not supply-driven (Delgado et al. 1999, 1). Furthermore, the Livestock Revolution is portrayed as unfolding on a whole new quantitative level. The consumption of milk and meat in the Majority World between the 1970s to the mid-1990s is reported to be "over half as large" as the Green Revolution's upsurge in cereal consumption (Delgado et al. 2000, 2). In addition, the Livestock Revolution is not only much larger but also much more lucrative. Its market value rose by approximately 155 billion USD, "more than twice the market value of increased cereals consumption" under the Green Revolution (Delgado, Rosegrant, and Meijer 2001, 1). Hence, big money is at play.

211 In a more recent estimate, the Global Agenda expects the global demand for meat to rise by 85 percent from 2005/2007 to 2050 (Global Agenda for Sustainable Livestock 2016h). For milk, *Tackling Climate Change* expects an increase of 58 percent from the level in 2010 (Gerber et al. 2013, 1).

212 MacLachlan has calculated the fastest growth in the slaughter of different animal species (in absolute numbers) per region: for chickens, it is China and the USA, for pigs: China, goats: South Asia, China and Africa, cattle: India, Brazil and China (MacLachlan 2015, 29). For a full list of growth in demand for livestock products from 2000 to 2030 in different world regions, compare FAO 2011b, 20.

As specified above, the reasons advanced for the Revolution are income increase, population growth, and urbanization. Income growth is portrayed as the principal reason for the Livestock Revolution (Delgado et al. 1999, 5; FAO 2011b, viii; ILRI 2000a; Steinfeld et al. 2006, 9).[213]

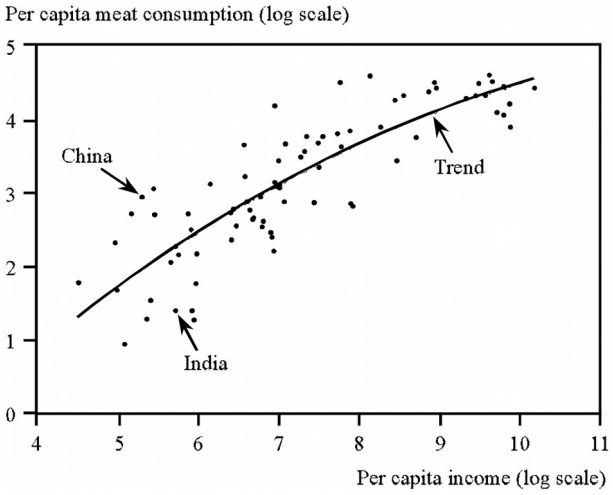

Figure 9: "The relationship between meat consumption and income."

Reprinted from "Livestock to 2020: The Next Food Revolution: Food, Agriculture, and the Environment," by Delgado et al., 1999, p. 6.

www.fao.org/Ag/againfo/resources/documents/lvst2020/20201.pdf. Copyright 1999 by International Food Policy Research Institute. Reprinted with permission.[214]

The hypothesis and storyline of *increased income is equal to increased expenditure on livestock products* is supported by figure 9 showing the positive, curved relationship between per capita income and per capita meat consumption. The outliers in the figure are attributed to cultural or religious characteristics. China is pictured as having a high preference for pork, whereas in India meat consumption is less widespread due to religious dietary rules. Price changes are mentioned as another economic factor for bigger consumption. Real prices of cereals, milk and meat have significantly fallen since the 1980s (Delgado et al. 1999, 6) (compare section 5.6.3).

In the Majority World, the proliferations in consumption have been "patchy" with massive upsurges in consumption in China and Brazil, yet almost no growth in Sub-Saharan Africa. In Sub-Saharan Africa, with the exception of South Africa for poultry and Kenya for milk, there has even been a reduction in the per capita consumption of animal foods (Dijkman 2009, 2, compare also Sumberg 2003). The FAO concludes: "It would appear that economic growth must accompany population growth if the 'revolution' is to occur" (FAO 2011b, 3).

213 For a study on the correlation between gross domestic product and meat consumption, see Speedy 2003.

214 "Note: Each dot is an observation for 1 of 78 developing and developed countries examined. The solid line is a statistically significant trend." (Delgado et al. 1999, 6).

Population growth is another factor for the Livestock Revolution: more people consume more meat and milk in absolute numbers. Population growth has been rapid in countries of the Majority World: 2.1 percent per annum between 1970 and 1995 on average, according to the authors (Delgado et al. 1999, 8). Due to this rise, demand for animal protein would grow "enormously" even without an increase in per capita consumption, and this trend will continue (Delgado et al. 1999, 12). Nonetheless, population growth equally requests a boost in cereal production by 50 percent by 2050 (Herrero and Thornton 2013, 20878), yet nobody speaks of a "Cereal Revolution." By 2050, the world population is expected to reach 9.3 billion (FAO 2016k). Most of this growth will take place in in the Majority World (FAO 2011b, 3), particularly in Sub-Saharan Africa (Thornton 2010, 2854). By 2050, the Majority World will be the home of 90 percent of the population (Deutsch, Lannerstad, and Ran 2011, 3).

The authors of the Livestock Revolution nominate urbanization as another major factor contributing to higher meat consumption.[215] Affluent urban citizens are described to be more likely to diversify their diets because they have more access to a variety of foods and they are said to prefer convenience over caloric content (Delgado et al. 1999, 6). Urban populations share different features: the average number of people in a household is smaller than in rural areas, and they include many single-person households. Moreover, urban populations have higher disposable incomes than rural populations, and, finally, they are confronted with intercultural exchange and international trade (Smil 2002, 305–6; Steinfeld et al. 2006, 8).

Still, the Revolution is "not a ubiquitous phenomenon" (FAO 2011b, 6). In stark contrast to the Majority World, the demand for animal protein in the Minority World is described as stagnating. In 1999, the authors of the Livestock Revolution explain this low growth by pointing to "slow population growth, slowing urbanization, satiation of diets, and growing health concerns about high intakes of cholesterol and saturated fatty acids from some animal products" (Delgado et al. 1999, 59–60). In 2011, the FAO wrote that in the Minority World, "people already eat as much animal-source foods as they need and would like to," and observed a trend of reduced consumption (FAO 2011b, 20). The feared health effects of a diet heavy in animal fats, whether cardio-vascular diseases, cancer, zoonosis, or pathogens related to those products, have resulted in "sporadically and sometimes permanently suppress[ing] demand for animal products" (Steinfeld and Chilonda 2006, 5). Between 1961/1963 and 1997/1991, per capita consumption of animal protein increased by 25 percent, but stagnated from 1985-2004 (Steinfeld 2004, 21). For some authors, the "meat phase" is over:

215 Urbanization will increase from 50 percent in 2008 to 70 percent in 2050, however very unevenly distributed (FAO 2011b, 4). Whereas in Latin America and the Caribbean, more than 80 percent of the population will be urban dwellers, in Africa, it will only be a fifth of the population (Dijkman 2009, 3).

> "With low or no population growth, most OECD countries are past the 'meat phase' and markets as well as people are saturated." (Steinfeld and Chilonda 2006, 5).

However, these projections are not without controversy among the institutions that put them forward. Pica-Ciamarra and Otte, researchers at the FAO Pro-Poor Livestock Policy Initiative, problematize the essential arguments of the Livestock Revolution. According to their article "The 'Livestock Revolution': Rhetoric and Reality" (Pica-Ciamarra and Otte 2009), the growth in the livestock sector does not merit the term "revolution." Their critique concerns, first, the geographic scale of the Revolution, second, the supposed reasons for Revolution, and thirdly, the pace of the sector's growth. First, Pica-Ciamarra and Otte deem the Revolution a regional phenomenon rather than a global one, affecting only a few countries (in particular China, India and Brazil), and not all products from animal exploitation. Even on a smaller scale, the previously mentioned differences between classes and between rural and urban areas are remarkable.[216] Hence, general assertions about the Majority World (in the original: the "developing world") are problematic (Pica-Ciamarra and Otte 2009, 8–9). Second, Pica-Ciamarra and Otte argue that the Revolution can predominantly be assigned to population growth and not to urbanization or income growth as purported by the Revolution authors. The exception is China, where the urban population consumes double or triple the amount of animal foods consumed by the rural population (Steinfeld and Chilonda 2006, 6). Third, the authors contend that, although the Revolution report from 1999 asserts a "rapid growth" of the sector, it does not substantiate what

216 Pica-Ciamarra and Otte challenge the assertions of the Revolution report that global diets are undergoing a fundamental shift by comparing national food baskets of regions in the Majority World in the years 1980 and 2003. The comparison shows, according to the authors, that there are no distinguishing changes in food habits in Latin America, the Middle East, North Africa and Sub-Saharan Africa. Preference shifts for meat and milk are recorded in South Asia (meat constituted two percent of the basket by weight in 1980, and remained two percent in 2003; the percentage of milk in the basket rose from 16 to 21 percent) and East and Southeast Asia (the percentage of meat increased from five to nine percent of the food basket, and milk from two to three percent). Yet, the biggest change has taken place in the consumption of fruit and vegetables in East and Southeast Asia: their share of the food basket more than doubled from 23 to 52 percent. Yet, nobody is talking about a "fruit and vegetable revolution" (Pica-Ciamarra and Otte 2009, 7–8). Furthermore, the Revolution document claims that the rise in consumption is a phenomenon of the Majority World. Pica-Ciamarra and Otte analyze changes in annual per capita consumption of meat and milk from 1980/82 to 2001/03 and argue that a) there was a steady surge in the consumption of meat and milk in the Minority World, b) milk consumption has remarkably risen in South Asia, but not meat consumption, c) in North Africa and the Middle East, meat and milk consumption have been stagnating, and d) East and Southeast Asia, and Latin America showed an extraordinary increase in meat consumption, yet, not milk consumption (Pica-Ciamarra and Otte 2009, 12–13).
Steinfeld provides a detailed regional assessment of the Revolution (however, without denying its existence): Sub-Saharan Africa has low levels of animal protein consumption which constitutes five percent of daily caloric intake. Consumption will not outstandingly increase. In North Africa and Near East, the total consumption of animal protein is also relatively low, around 8.7 percent of caloric intake in 1997/1999. In Latin America and Caribbean, the intake of animal foods has a longer tradition and is relatively high: in 2004, animal protein represented 16.6 percent of caloric intake. Brazil has a special position, with 18.8 percent; consumption is expected to approach industrial levels by 2030. South Asia shows large increases in milk and poultry consumption. In East Asia, consumption of pig meat is especially increasing. In China, caloric intake levels were 15 percent in 2004, and are supposed to augment to 20 percent by 2030. Milk consumption is very low (seven kilograms in 1997/1999), however, egg consumption is extremely high (15 kilograms in 1997/1999) (Steinfeld 2004, 22–23).

"rapid" exactly conveys. Pica-Ciamarra and Otte analyze the annual growth rate in per capita meat and milk consumption by region for 1980 to 2003. According to their data, average annual growth rates, being lower than two percent, cannot be considered "rapid," with the exception of East and Southeast Asia, and Brazil (Pica-Ciamarra and Otte 2009, 9–10).[217] Notwithstanding their interesting assertions, their fundamental critique and the denial of the advent of a food revolution has not been echoed at the FAO, International Livestock Research Institute, or International Food Policy Research Institute.

PART A CAPITALIZING ON AND CONTROLLING NATURE

5.4 Sustainable intensification

How should the massive and rapid increase in both consumption and production of animal protein be achieved? And how can its environmental and social challenges be mastered at the same time? The solution for "sustainably" furthering the Livestock Revolution has already been identified in the 1999 report (Delgado et al. 1999, vii): sustainable intensification. In the years after the Revolution document, the discourse of sustainable intensification in the animal-industrial complex has taken hold and gained standing. The multi-stakeholder partnership Global Agenda for Sustainable Livestock already bears the greening of the sector in its name.[218] The Agenda partners believe that the livestock sector can address poverty and hunger eradication and the projected upsurge in demand by "promoting a sustained economic growth, inclusive social development and an efficient use of natural resources" (Global Agenda for Sustainable Livestock 2015a, 4). Indeed, "green livestock growth" and "greening livestock sector growth" are key messages of the Global Agenda (Global Agenda for Sustainable Livestock 2016h). As elaborated in section 3.3.4, both the expansion of industrial agriculture and small-scale organic farming have in the past been defined as measures of sustainable intensification. Yet, the approach chosen in the Livestock Revolution is its "harder, faster, better" version, the forceful furtherance of intensive production. The instruments suggested could have come straight from an ecological modernization textbook: "technological progress in the production, processing, and distribution of livestock products," "[r]apid advances in feed improvement and genetic and reproductive

217 MacLachlan maintains that the statistical picture of annual growth rates in consumption turns out to be complex. In Brazil, China, USA, Central America, and South America, average annual growth rates in meat consumption in kilotons and per capita have been higher in the period 1991-2001 than in the period 2001-2011. In India, Southeast Asia, and Africa, they have been higher in the period 2001-2011 than in the period 1991-2001. China, Brazil, Central America, and Southeast Asia have witnessed the biggest growth rates. On average, global growth rates have equalized (meat consumption in kilotons: 1991-2001: 2.7 and 2001-2011: 2.8 and meat consumption per capita: 1991-2001: 1.1 and 2001-2011: 1.3) (MacLachlan 2015, 26).

218 At its sixth multi-stakeholder partnership meeting in Panama in June 2016, the Agenda developed the Panama Declaration committing themselves to the "sustainable development of the livestock sector, to generate widespread benefits for people and the planet." (Global Agenda for Sustainable Livestock 2016e). The Agenda's "main orientation" is the United Nations 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals (Global Agenda for Sustainable Livestock 2015a, 1).

technologies," and "[i]nstitutional and regulatory development" (Delgado et al. 1999, 4). What follows is a presentation of the predominant measures and storylines of, first, efficiency increase and intensification, second, technological innovation, and third, regulation, management, and policy reform. As will be elaborated in the fourth section, they are, in sum, all measures for capitalizing on and governing nature as proposed by ecological modernization theory.

5.4.1 Efficiency

The number one instrument for business-as-usual sustainable intensification is increasing productivity via increasing efficiency. Efficiency can have many aspects. For the Livestock Revolution authors, it equals industrialization. Industrial systems are presented as innately efficient operations: they are "knowledge- and management-intensive," they "maximize[s] the use of scarce resources," they mobilize genotypes and biotechnology, and improve animal husbandry and veterinary care (Delgado et al. 1999, 17). Feeding practices in industrial agriculture are "sophisticated," applying phased feeding, feed additives, and synthetic amino-acids (Delgado et al. 1999, 18). In contrast, grazing systems are presented as "traditional operations," which is to say, inefficient, not "knowledge-intensive" or "sophisticated." The Revolution report claims that grazing systems cover about 26 percent of the world's land surface (Delgado et al. 1999, 45) yet provide only ten percent of meat production. In addition, with increasing land scarcity, "grazing systems lead to either land degradation and economic decline," or they develop into mixed or industrial systems (Delgado et al. 1999, 17). Twenty percent of the world's grazing areas are actually already degraded (Delgado et al. 1999, 45).

The International Livestock Research Institute highlights the need to sustainably intensify smallholder mixed systems, on which the majority of poor people in the livestock sector rely (ILRI 2000a; 2002, 7; Wright et al. 2012); moreover, it calls to combine biotechnology and industrialization with agroecological approaches (Pinstrup-Andersen, Pandya-Lorch, and Rosegrant 1999). This suggestion remains isolated, however. Ten years after the Revolution document, the discourse of intensification and structural change is alive and kicking. The FAO indicates that there are three options for coping with bigger demand: production must "rapidly" intensify, the number of producers must go up, or imports must increase (FAO 2011b, vi, 21). In regions where imports are not projected to increase, such as in India, domestic production must massively and rapidly intensify (FAO 2011b, 22).

There are substantial differences in productivity and resource use efficiency between different regions, types of livestock systems, and animal products, suggesting potential for improvement (Herrero and Thornton 2013, 20879). In the Majority World, the reduction of emissions per unit of output should be achieved through intensification, according to the 1999 report (Delgado et

al. 1999, 56). The 2013 FAO study *Tackling Climate Change* observes "a direct link between GHG emission intensities and the efficiency with which producers use natural resources" (Gerber et al. 2013, xiii). Emission intensities are the emissions per unit of animal product. The range between the lowest and the highest emission intensities in milk production, for example, is from below 1.7 kilograms of carbon dioxide equivalents per kilogram milk to nine kilograms of carbon dioxide equivalents per kilogram milk.[219] In this logic, the culprits are, again, grazing systems. They have, on average, the highest emission intensities (Gerber et al. 2013, 25–26).[220] By the same token, industrial systems have the lowest emission intensities for both ruminant and monogastric production.[221]

To close this efficiency gap, strategies exist at the animal, production unit, and supply chain levels. At the animal level, better animal health, feed digestibility and balance, and improved breeding and genetics are methods that apply to both ruminants and monogastric animals (Hammond 2000; Rege et al. 2011). At the production unit level, manure management and feed production can be improved, and equipment should be energy efficient. At the supply chain level, waste should be minimized, and energy efficiency fostered (Gerber et al. 2013, 84).[222] In total, emissions could be diminished "by between 18 and 30 percent […], if producers in a given system, region and climate adopted the practices currently applied by the 10 to 25 percent of producers with the lowest emission intensity." (Gerber et al. 2013, 44). The authors of the *Tackling Climate Change* report underline that the achievement of this mitigation potential does—in principle—not necessitate a change in production systems,[223] but that the shift is de facto al-

219 "Emission intensities for beef are highest in South Asia, Sub-Saharan Africa, Latin America and the Caribbean, and East and Southeast Asia […]. Higher emissions are largely caused by low feed digestibility (leading to higher enteric and manure emissions), poorer animal husbandry and lower slaughter weights (slow growth rates leading to more emissions per kg of meat produced) and higher age at slaughter (longer life leading to more emissions)" (Gerber et al. 2013, 26).

220 "The major mitigation potential lies in ruminant systems operating at low productivity, for example, in Latin America and the Caribbean, South Asia and Sub-Saharan Africa. Part of the mitigation potential can be achieved through better animal and herd efficiency. Mitigation potential is also important in intermediate pig production systems of East and Southeast Asia." (Gerber et al. 2013, 44).

221 For ruminant production, as productivity increases, emission intensity decreases (Gerber et al. 2013, 42–43). The OECD countries are home to 20 percent of the global number of dairy cows, however, they produce 73 percent of global milk (Gerber et al. 2013, 76). The relationship is different for monogastric production, for example pig production. It takes the shape of an inverted U curve: emission intensity in intermediate systems is higher than in both backyard and industrial production. As backyard spaces are limited, it is suggested to scale intermediate systems up to industrial systems (Gerber et al. 2013, 42–43). Interestingly, this assertion mirrors the Environmental Kuznets curve discussed in chapter three.

222 "Possible interventions to reduce emissions are thus, to a large extent, based on technologies and practices that improve production efficiency at animal and herd levels. They include the use of better quality feed and feed balancing to lower enteric and manure emissions. Improved breeding and animal health help to shrink the herd overhead (i.e. unproductive part of the herd) and related emissions. Manure management practices that ensure the recovery and recycling of nutrients and energy contained in manure and improvements in energy use efficiency along supply chains can further contribute to mitigation. Sourcing low emission intensity inputs (feed and energy in particular) is a further option." (Gerber et al. 2013, xiii).

223 "This mitigation potential does not imply any farming system change and is based on existing and already applied technologies" (Gerber et al. 2013, 46); "the mitigation potential can be achieved within existing systems; this

ready taking place (Gerber et al. 2013, 47).[224] The International Food Policy Research Institute has labeled this development "livestock industrialization" (Delgado and Narrod 2002; Delgado, Narrod, and Tiongco 2008).

Closing the efficiency gap is a priority of the Global Agenda for Sustainable Livestock as well. For the Agenda partners, it is indispensable to elevate both natural resource efficiency and profitability (Global Agenda for Sustainable Livestock 2016h). Notably, efficiency increase is even defined as the first principle of sustainability (Global Agenda for Sustainable Livestock 2014b, 9).[225] To enlarge productivity yet decrease land use, the sector should aim at "faster live weight gains," "higher land-use intensity," "higher pasture productivity," and "larger use of cultivated feeds of good nutritive quality" (Global Agenda for Sustainable Livestock 2016h).

Private-public partnerships are a central instrument for reaching efficiency (Global Agenda for Sustainable Livestock 2016i, 2016b), and the private sector is lauded for its green initiatives and its "leadership role."[226] The Revolution report already claims in 1999 that the "private sector has played an important and often dominant role in boosting livestock productivity and solving environmental problems in industrial systems." (Delgado et al. 1999, 63).

Paradigmatic cases of ecological modernization are the promises of the environmental *and* economic benefits of mitigation interventions, a typical win-win situation (Gerber et al. 2013, xiii). These technologies and practices foster "sustainable food production, economic growth and poverty alleviation" (Gerber et al. 2013, ix), serving "both mitigation and development objectives" (Gerber et al. 2013, xv). A "double," or perhaps "triple dividend" is expected by the Global Agenda, too, which acts "towards improved sector performance by targeting natural resource protection, while including poverty reduction and public health protection" (Global Agenda for Sustainable Livestock 2016b).

5.4.2 Technology

means that the potential can be achieved as a result of improving practices rather than changing production systems (i.e. shifting from grazing to mixed or from backyard to industrial)" (Gerber et al. 2013, xiii).

224 "If the mitigation potential identified in this assessment does not require any system change, nor any change in the mix of products generated by the sector (i.e. milk, eggs, beef, etc.), these changes are de facto taking place and affect the overall emission intensity of livestock. The two commodities currently showing highest growth rates are among those with lowest global average emission intensity, namely milk and poultry […], which will tend to reduce average emission intensity per unit of protein. This is further accentuated by the fact that most of the growth is taking place among high productivity (dairy) and intensified (industrial broilers and layers) systems, which generally have the lowest emission intensity." (Gerber et al. 2013, 47).

225 The Agenda's five principles of sustainability are to: "(i) increase efficiency; (ii) enhance livelihoods and human well-being; (iii) protect resources; (iv) increase resilience; and (v) improve governance." (Global Agenda for Sustainable Livestock 2014b, 9).

226 In fact, the *Tackling Climate Change* publication explicitly mentions the International Dairy Federation, the U.S. Cattleman Association, and the "Walmart's Global Sustainable Agriculture Goals" (Gerber et al. 2013, 98).

> "Technology remains the key component because future development, including that of the livestock sector, will depend upon land- and water-saving technology to substitute for use of natural resources. This trend toward knowledge-intensive systems can be widely observed. Smart technologies, supported by astute policies, can help to meet future demand while maintaining the integrity of the natural resource base" (Delgado et al. 1999, 57).

> "Technology is necessary for the radical redirection of global food systems" (Thornton 2010, 2864).

Technological change is presented as "the key to solving environmental problems" (Delgado et al. 1999, 48), and to foster productivity. For the publication *Livestock's Long Shadow*, the "most promising approach" to decreasing emissions from farmed animals is "better nutrition and genetics," including the genetic manipulation of the animal's digestion (Steinfeld et al. 2006, 119). In the words of the *Tackling Climate Change* document, breeding and genetics should "increase feed conversion ratios and reduce nitrogen and organic matter excreted per unit of product" (Gerber et al. 2013, 84). 50 to 90 percent of the nutrients in animal feed are excreted in manure, and 20 to 30 percent of the dietary energy are not digested by farmed animals (Global Agenda for Sustainable Livestock 2016i). Concrete measures in feed technology include probiotic and antibiotic feed additives, microbiological techniques, microbial genomics, precision in animal feeding, changing the rumen to better digest high-fiber feed, and administering growth hormones (Delgado et al. 1999, 52–54; McCrabb et al. 2005).

Reproductive technologies are equally to be applied and improved. They range from artificial insemination, embryo transfer, selection of local breeds and crossbreeding, to advances in genetics (Delgado et al. 1999, 52–58; Rothschild and Plastow 2014). Genetic engineering is generally used as a method for sustainable intensification (Holloway 2015). Genomic selection, introduced in subdivision 2.1.4.2, might "revolutionize animal breeding" as a whole, according to Thornton (2010, 2858). Onteru, Ampaire, and Rothschild (2010) explore the possibilities of transgenic technology and animal cloning in the Majority World. Other directions are nanotechnology[227] and transgenic livestock. Thornton maintains that nanotechnology "could redefine the entire notion of agriculture and many other human activities" (2010, 2864).[228] Even though most

227 Nanotechnology involves matter at the nanometer, this means of 1-100nm size (Kuzma 2010).

228 Uses of nanotechnologies in animal production include the detection and removal of pathogens and microbial contaminants in CAFOs (on dead or live animals, in their waste, and feed), the delivery of vaccines or hormones, genetic engineering of livestock increasing reproduction and fertility, the quality/design of animal-derived food, and supply-chain tracking (Chen and Yada 2011; Kuzma 2010). Nanotechnology can be used to improve water quality and availability in terms of microbial disinfection, desalination, and removal of heavy metals. Moreover, it can enhance animal feed by adding nutrients or digestive aids, hereby increasing feeding efficiency and ultimately profitability. Precision farming, minimizing inputs and maximizing outputs, is an area of application in feed production. Nanotechnology can help deliver agricultural chemicals and therefore decrease run-off, it can be deployed in field sensing systems, or genetic engineering (Chen and Yada 2011, 586–90).

nanotechnological applications in the agricultural sector are still at the research and development stage, researchers are confident that they will be applied on a large scale in the near future (Chen and Yada 2011, 586). Transgenic animal milk with human proteins, on the other hand, could be "essential for lowering the production costs of numerous pharmaceuticals that remain out of reach for all but the relatively rich," according to the 1999 Revolution report (Delgado et al. 1999, 43).[229] Transgenic technology can change existing genetic information or introduce new, exogenous information into genomes. The difference from traditional breeding is that transgenic technology does not halt at the "species barrier" but can select desired traits of other species (Laible 2009, 123–24).[230]

One crucial element is the transfer of technology and knowledge from the Minority World to the Majority World (Delgado et al. 1999, 52), or, in the words of the Global Agenda, "from the world's most to least efficient production systems."[231] Such transfer would cover genetics, feeding systems, and animal health control (Global Agenda for Sustainable Livestock 2016h). The adoption of biotechnology in the Majority World should be promoted through microfinance schemes or subsidies if long-term financial aid is needed (Gerber et al. 2013, xiv, refer also to ILRI 2002, 17).

Shifting from low-productive breeds to fewer animals of high-productivity is one strategy for the Livestock Revolution (Herrero et al. 2009, 117).[232] Another tactic is to switch from exploiting ruminants to exploiting monogastric species (Herrero and Thornton 2013, 20879). By 2020,

229 Human milk has a high concentration of the antimicrobial protein lysozyme (Laible 2009, 128).

230 Given the prevalent lactose intolerance of the majority of people around the globe, one (lucrative) aim of transgenic technology is to lower the content of lactose in (cow) milk. Such transgenic milk, "an elegant alternative to expensive post-harvest milk processing," is being researched in mouse models (Laible 2009, 128). The reduction of unhealthy saturated fatty acids is another clear objective in developing transgenic milk and meat. Animal fats provoke coronary heart and cardiovascular diseases. To solve this problem, alien enzymatic activities are being introduced in mammals, inducing a higher concentration of unsaturated fatty acids and even of omega-3 fatty acids that are normally found in fish. According to Laible, this "sustainable strategy to fortify meat" could compete with the current practice of feeding fishmeal to livestock (Laible 2009, 130–31). The environmental benefits of transgenic technology are, apart from boosted productivity and the reduction of livestock in numbers, mitigation methods: for instance, the introduction of genes to better digest and utilize feed can diminish phosphate supplements and, thus, phosphate excretion. The future risks of climate change, and the "immense pressures" that will be put on livestock including a possible "struggle for survival" are an important justification for transgenic technologies, according to Laible (2009, 132–33).

231 Technologies "have to be adapted and disseminated to the developing world to eliminate low productivity" (Delgado et al. 1999, 52).

232 However, *Tackling Climate Change* warns that the emission intensity from beef produced from specialized breed herds is twice as high as from dairy herds. "This difference is primarily due to the fact that dairy herds produce both milk and meat while, on the other hand, specialized beef herds mostly produce beef. As a consequence, emissions from dairy herds are attributed to milk and meat while emissions from beef herds are allocated to meat (in both cases, a limited fraction is allocated to other goods and services, such as draught power, and manure used as fuel)." (Gerber et al. 2013, 24–25). In Europe, only 20 percent of beef stems from specialized breed herds; the majority stems from dairy cows and "surplus calves," which explains low emission intensities (Gerber et al. 2013, 26).

44 percent of total meat production will stem from chickens, which will be the number one exploited species (Deutsch, Lannerstad, and Ran 2011, 1).

5.4.3 Policy reform, regulation, management

> "The worst thing that well-motivated agencies can do is to cease public investments that facilitate economic, sustainable, and small-operator forms of market-oriented livestock production. Lack of action will not stop the Livestock Revolution, but it will help ensure that the form it takes is less favorable for growth, poverty alleviation, and sustainability in the developing countries." (Delgado et al. 2000, 10; Delgado, Rosegrant, and Meijer 2001, 21).

> "Experience in both developed and developing countries confirms that a laissez-faire approach, simply standing back and allowing market forces to play out, is not a viable option." (FAO 2005, 3).

Next to technological change, ecological modernization theory and similarly the discourse of the Livestock Revolution advise environmental regulation and management of waste (Gerber et al. 2005), feed, and water (Amede et al. 2009; Sraïri 2011) to "sustain growth." Mechanisms mirroring the value of natural resources are proposed as a general mitigation option (Delgado et al. 1999, 48). *Livestock's Long Shadow* advocates pricing natural resources in order to internalize the "externalities" of environmental degradation:

> "Most frequently natural resources are free or underpriced, which leads to overexploitation and pollution" (Steinfeld et al. 2006, xxiii).
> "A top priority is to achieve prices and fees that reflect the full economic and environmental costs, including all externalities" (Steinfeld et al. 2006, xxiv).
> "There should be secure and if possible tradable rights to water, land, use of common land and waste sinks" (Steinfeld et al. 2006, xxiii).
> "Many environmental goods and services are not traded and, while they are obviously valued by society, they do not have a market price. In the absence of a market, valuing the environment in an appropriate way presents formidable challenges" (Steinfeld et al. 2006, 223).

The *Tackling Climate Change* report recommends "to introduce supporting policies to constrain emissions in the sector (e.g. through tradable or non-tradable emission permits)" and regulations against deforestation (Gerber et al. 2013, 88). Nature is correspondingly transformed into a market by comprehending the animal-industrial complex as a "livestock-based bio-economy." For the Global Agenda, a bio-economy "generates smart, resource efficient, and carbon-neutral con-

sumption and production methods and technologies." (Global Agenda for Sustainable Livestock 2015a, 33).[233]

As outlined earlier, the Livestock Revolution discourse depicts pastures as inefficient and degraded. The Revolution authors charge "inadequate property rights or enforcement mechanisms" and "lack of market access," but also "politically motivated subsidies to large producers" (Delgado et al. 1999, 10, 58). For the Global Agenda, overgrazing is a consequence of low productivity, and poverty (Global Agenda of Action 2013, 5). Steinfeld even terms it "poverty-led degradation" (Steinfeld 2004, 35).[234] As a solution, the Revolution authors suggest "[i]nstitutional change in property rights in commercializing smallholder areas" (Delgado et al. 2000, 10) and grazing fees to lessen grazing pressure (Delgado et al. 1999, 58). A more radical proposal is to reorient pastoralists to provide environmental services. In contrast to taxing the use of natural resources (FAO 2005, 6–7), the instrument "payments for ecosystem/environmental services" (outlined in part 3.3.3) compensates those people who do *not* use resources, but safeguard them. *Livestock's Long Shadow* advances payment for ecosystem services as a solution on the local, national and international level (Steinfeld et al. 2006, 281). The discourse targets extensive, traditional systems that are "often difficult to intensify."[235] In addition, extensive systems face "market barriers in accessing modern value chains," and can thus not compete (Gerber et al. 2013, 2). Consequently, the suggestion is to stop extensive farming:

> "Little productive extensive systems," "doubtful" to survive in a world demanding for "environmental services", "[…] need to be re-oriented towards adding environmental service provision, rather than mere production or subsistence" (Steinfeld et al. 2006, 280).

In sum, biodiversity stewardship, carbon sequestration,[236] and eco-tourism can be future markets for the services of poor smallholders (ILRI 2002, 7).[237] Herders and livestock keepers should be compensated for these services and concomitant grasslands restoration. Yet, in order for these

233 In more detail, a "bio-economy strives to integrate the biomass flows of different industries in such a way that one industry's waste or emissions become another industry's raw material." As livestock uses a large part of human-appropriated biomass, the sector must be linked to the bio-economy. "The bio-economy, particularly the livestock-based bio-economy, is an essential part" of the solutions to future food and water need, and climate change mitigation and adaption, according to the Agenda, and they suggest transforming organic waste into "a range of value-added products." Such biomass can be used as "renewable raw materials for industry" (Global Agenda for Sustainable Livestock 2015a, 43).

234 "[P]overty-led degradation is occurring in semi-arid and humid environments due to increased population pressure, ill-defined resources access, and poor access to markets and financial services. Degradation reinforces poverty by reducing the productivity of shared resources and by increasing vulnerability." (Steinfeld 2004, 35).

235 See in addition Steinfeld et al. 2006, 118–19. The Revolution authors maintain that "[i]n places where land is 'free' (such as most of the African Sahel), more intensive use of the land without additional inputs could further degrade its productivity." (Delgado et al. 2000, 9; Delgado, Rosegrant, and Meijer 2001, 20). Note the problematic description of the "free land."

236 The potential for carbon sequestration in grassland areas is considerable and could offset around 0.6 gigatons carbon dioxide equivalents per year (Gerber et al. 2013, xiii, 89).

mechanisms to work, institutional change is necessary. Communally managed land "without clear ownership or access entitlements" is not only blamed for land degradation, but can similarly pose "significant challenges" for carbon sequestration. The hurdles include management, "ownership of soil carbon assets," and monitoring to decrease non-permanence risks (Gerber et al. 2013, 89). Fundamentally, common-property pastures do not fit the industrial model of livestock production: the return on investment to individuals is complicated (Costales, Gerber, and Steinfeld 2006, 23).

Nevertheless, the authors of the Livestock Revolution do not only criticize pastoralists and common property regimes. In a rather conflicting account, they place responsibility on the dominant development: subsidized, polluting, large-scale industrial production promoted by market distortions (Delgado et al. 2000, 10, 48).[238] Next to subsidies, governments should tackle trade policies and exchange rates, develop environmental regulation and financial incentives, and ensure market access and agricultural support services for smallholders (FAO 2005, 5–7; Gerber et al. 2013, 83–85). The Global Agenda even recommends "reconnecting specialized livestock production to crop agriculture" (Global Agenda of Action 2013, 3) in order to recycle nutrients and energy in manure, principally reverting the metabolic rift introduced in the part on CAFOs (2.1.3.1). Such recycling provides mineral fertilizer and simultaneously curtails waste, nutrient overload, and greenhouse gas emissions (Global Agenda of Action 2013, 5).[239] Herrero et al. topple the astonishing disruption in the discourse with a uniquely controversial assessment:

> "Research on mechanisms for de-intensifying these [industrial] systems is an exciting new opportunity that requires further research to fully elucidate the impacts of these changes on food supply and environmental impacts." (Herrero et al. 2009, 113).

Nonetheless, the literature on environmental mitigation technologies and practices is much vaster than the one on policies (Gerber et al. 2013, 91). The *Tackling Climate Change* text disapproves that mitigation policies remain, in the end, non-binding,[240] and that they have to be economically attractive in order to gain acceptance (Gerber et al. 2013, 99–100). Yet, they argue that "collective action is now urgently needed" (Gerber et al. 2013, 101), given "the nature of

237 Another option are silvo-pastoral techniques. In silvo-pastoral systems, farmers raise more animals per hectare, still, they compensate those emissions by planting and conserving trees (FAO 2005, 6–7).

238 "Distortions in domestic capital markets often promote inefficient, large-scale pig, milk, and poultry production in the peri-urban areas of developing countries. These policies distort the pattern of livestock development and ultimately cannot be sustained. Further, poor environmental regulations, distortions in the marketing chain that prevent competition from rural areas, and lack of legal accountability for pollution promote urban piggeries and dairies that cannot adequately dispose of waste materials." (Delgado et al. 2000, 10).

239 The Agenda calls this tactic "Waste to worth." Methods include using animal manure as fertilizer on crops or in fishponds, or using it as compost or for biogas production (Global Agenda for Sustainable Livestock 2016i).

240 The authors draw a parallel to the Kyoto Protocol. An additional shortcoming is that most carbon markets do not include the emissions of the livestock sector (Gerber et al. 2013, 92).

climate change as a global public good," and "the effect of climate [change] has started to be felt in everyone's life" (Gerber et al. 2013, x).

5.4.4 Critique

The suggested measures to further the Revolution and control the environmental repercussions fit the classic eco-modernist agenda: the storylines range from the belief in technological progress, managing the environmental crisis with regulation and institutional change, to public-private partnerships and the "triple dividend" expected in the combination of economic growth, natural resources protection, and poverty alleviation. The free market environmentalism of the Revolution discourse literally transforms nature into a market, allotting a price to and trading environmental goods and services. It calculates environmental damage, internalizes the "externalities," and remunerates environmental stewardship, as in the proposed reorientation of farmers towards the provision of ecosystem services.

In a quantitative diachronic study of the Revolution discourse, the growing prominence of valuing nature in economic terms is represented by the increasing appearance of words like "natural resource use," "environmental assessment," "environmental accounting," or "environmental services." Resonating the discursive shift from nature to environment historically observed by Luke (1995, 60) (compare chapter three), the Revolution report (Delgado et al. 1999), the *Tackling Climate Change* publication (Gerber et al. 2013), and the Global Agenda Action Plan (Global Agenda for Sustainable Livestock 2015a) never reference "nature" as such (compare the discourse statistics in appendix 3).[241]

Extensive and subsistence agriculture of "the poor" is blamed for environmental—"poverty-led"—degradation and inefficiency (Steinfeld et al. 2006, 114, 280). Land degradation is depicted as "tragedy of the commons," hence the call for a change in property rights and institutions. In the words of Luke, this form of sustainable development is sustainable *degradation*. The degradation inherent in the sector's growth is not perceived as a problem as long as there are mechanisms to monitor and manipulate it (Luke 2006, 99). The necessity of such "green livestock growth" disregards the inherent biophysical contradictions of capitalism—the impossibility of infinite growth in a finite world, and the degradation of the very resources humanity depends on. Those contradictions and the problems originating in intensive agriculture are simply

241 Additionally, while it is obvious that the term "sustainable" would feature prominently in the Global Agenda Action Plan, its count of 155 mentions in 55 pages is still overwhelming. The word principally appears as "sustainable development," but also, and this is novel, as "sustainable sector development," "sustainable livestock," and "sustained growth" (Global Agenda for Sustainable Livestock 2015a).

overpowered in the industrial meat regime, and "solved" with more intensification—albeit "sustainable" one.[242]

In the animal-industrial complex, sustainable intensification signifies sustainable *exploitation*. As maintained in section 3.3.4 on sustainable intensification, the Livestock Revolution is the principal motive for the perceived need for sustainable intensification in the first place. Animal products are very resource-intensive, highly inefficient food items. But the obligation to consume them is seldom questioned. On the contrary, the dietary substitution of meat and milk for grain is presented as an obvious, biological fact (which will be discussed in-depth in section 5.7). This form of sustainable intensification hence follows a narrow productivism. One risk of such an approach is the rebound effect (compare footnote 157). As a matter of fact, *Tackling Climate Change* fears that the ecological benefits of efficiency improvements could be equalized by the subsequent expansion of production, both in increasing herd size, intensification, and additional clearing of land (Gerber et al. 2013, 87–88). Herrero and Thornton similarly observe the "perverse incentive" that increasing productivity and revenue incites farmers to increase their farm size, although the goal of "environmentally friendly animal farming" would be to "produce more with fewer but more productive animals." (Herrero and Thornton 2013, 20879).[243]

Environmental regulations, "sophisticated" feeding practices, "knowledge- and management-intensive" systems, genetics, optimizing emission intensities, carbon sequestration, knowledge transfer from the Majority to the Minority World, and institutional change are not neutral, apolitical mechanisms. Graeber defines policy the following:

> "The notion of 'policy' presumes a state or governing apparatus which imposes its will on others. 'Policy' is the negation of politics; policy is by definition something concocted by some form of elite, which presumes it knows better than others how their affairs are to be conducted. By participating in policy debates the very best one can achieve is to limit the damage, since the very premise is inimical to the idea of people managing their own affairs." (Graeber 2004, 9).

242 Ripple et al.'s observation on climate change mitigation also applies to the animal-industrial complex: "So far, global climate policy instruments have mainly focused on engineering improved industrial processes, energy efficiency and investments in alternative energy generation technologies, because sustainability has been predominantly interpreted as technological progress rather than changed patterns of human behaviour." (Ripple et al. 2013, 4).

243 The *Tackling Climate Change* report projects global average emission intensity to decrease, thanks to productivity gains. Further, the total emission intensities of the sector as a whole are projected to decrease, as well, because livestock products from monogastric species have a higher growth rate than products from ruminant species. Nonetheless, the efficiency gains will not be capable to offset the increasing emissions due to the sector's overall growth (Gerber et al. 2013, 100).

Technological progress, "necessary for the radical redirection of global food systems," according to Thornton (2010, 2864), is not a decontextualized "magic wand of ingenuity" either (Malm and Hornborg 2014, 64). FAO author Hoffmann lauds poultry breeding companies' "highly successful way of protecting their intellectual property investment in superior breeds" (Hoffmann 2005, 57). Such solutions are about making money. These measures reflect and entail a world of private property and state or corporate access and control, on both the intellectual and physical level. One is inclined to speak of "imperial meat" or "imperial milk."[244]

The discourse is saturated with storylines distracting from underlying power structures. The *Tackling Climate Change* document, in defining climate change as a matter of collective action, conceals globally differentiated responsibilities. Yet, such large-scale emissions are not "humanity's" fault: As presented in the third chapter, in 2008, the Minority World, home to 18.8 percent of the human population, has emitted 72.7 percent of carbon dioxide emissions since 1850. "A significant chunk of humanity is not party to the fossil economy at all"—the accountability for climate change of around a sixth of the populace tends to zero (Malm and Hornborg 2014, 65). This unequal liability is matched with the unequal distribution of ecological destruction, and the power to counter it—also as producers. All the texts fail to mention that people in the Minority World have the capital to outsource their environmental destruction, they have the capital to simply move their home or production to a region less affected by climate change, and they have the capital to apply mitigation strategies.

In summary, whereas the Minority World is responsible for the bulk of the ecological dilemma and meat consumption—consuming three times as much as the Majority World, the proposed changes, in the forms of intensification and new regulations, should chiefly take place in the Majority World (Steinfeld et al. 2006, 6, 81). As Banerjee states, "[t]he Third World, still in need of development, now needs to be told how to develop sustainably" (2003, 174).

5.5 Animals in the Livestock Revolution

How are animals portrayed in the Revolution discourse? What about animal welfare? As elaborated in the introduction, animal welfare is a growing concern worldwide; social movements and academia continue to draw attention to the emotional, intellectual and physical capacities of nonhuman animals. What about the papers examined in this study? And finally, what are the implications of sustainable intensification for farmed animals? What is particularly "sustainable" about sustainable intensification, and how do animals experience their exploitation turned sustainable?

244 This image reminds of *Imperial Leather* (MacClintock 1995).

5.5.1 Representation in the discourse

In the Livestock Revolution discourse, the machine-like language of the documents studied here corresponds to the instrumental and industrialized treatment of farmed animals. These animals are called "a key commodity for human well-being" (Herrero et al. 2009, 111) or mere "food producing animals" (Steinfeld 2004, 37); chickens and pigs are characterized as "short-cycle species" (Steinfeld 2004, 31). In the account of the poultry revolution, Farrell writes that "[b]ird performance is predicted to improve in all categories" (2002). After the outbreak of BSE, the "destruction of large numbers of animals" was necessary (World Bank 2005, x). Thornton et al. call animal genetic resources "the ultimate non-renewable resource" (Thornton et al. 2009, 120). Another illustration is the glossary of *Tackling Climate Change* which explicates some of the technical terms in livestock production. The applied terminology does not indicate the involvement of any sentient beings whatsoever; on the contrary, it defines the animals as pure machines of productivity, as in this brief list of examples:

> "**Age at first calving (farrowing)** The time spent between birth and first calving (farrowing); i.e. the age at which a heifer (gilt) becomes a cow (sow).
> **Breeding overhead** Animals dedicated to reproduction, rather than to production; i.e. animals necessary to maintain herd/flock size.
> **Broiler** Chicken reared for meat.
> **Cohort** Class of animals within a herd/flock defined by their age, sex and function (e.g. adult females, replacement females, males for fattening).
> **Co-product** Output from a production activity that generates more than one output (e.g. milk, meat, manure and skins are among the co-products of dairy production). The term does not include services that may also be provided (e.g. draught power).
> **Layer** Chicken reared to produce eggs for human consumption.
> **Productivity** Amount of output obtained per unit of production factor. In this report, it is used to express amount of product generated per unit of livestock and time (e.g. kg milk per cow per year)."
> (Gerber et al. 2013, xviii–xxi [original emphasis]).

If animals are principally portrayed as "production factors," what kind of consideration does their welfare get? In general, animal welfare merits only occasional mention,[245] yet its prominence grows over time.[246] The Revolution report classifies animal welfare as an issue of "intensified systems in developed countries," but also in India because of religious reasons. It addresses the "ethical issues" industrialization raises, as well as the "concerns about animal wel-

245 The two publications from animal welfare organizations, Garcés 2002 and AWFW 2016, are truly the sole documents on the Livestock Revolution that dedicate so much as an entire *paragraph* on the impact of the Revolution on farmed animals. Suffice it to say, animal welfare generally is almost never considered in climate change mitigation strategies in the livestock sector (Shields and Orme-Evans 2015).

246 Compare the discourse statistics provided in appendix 3.

fare and the unpleasantness suffered by those who live downwind from major industrial hog farms." (Delgado et al. 1999, 37).[247] In an Indian case-study of the Livestock Revolution, Khan and Bidabadi (2004, 102) remark on potential future "immense animal suffering." *Livestock's Long Shadow* maintains that animal welfare concerns motivate certain consumers to lower their consumption (Steinfeld et al. 2006, 11). Steinfeld lists animal welfare issues in "unregulated" intensified production. In such systems, animals are not able to express their "natural behavioural features," a condition "associated with real and suggested animal suffering." Long-distance trade is another detrimental element, as is genomic selection for increasing productivity that impinges the animals' skeletal and circulatory systems (Steinfeld 2004, 39). Steinfeld is convinced that consumers in "more affluent societies" are concerned by this situation and will assert a larger influence in regulating animal production (Steinfeld 2004, 39–40; compare also Vercoe, Fitzhugh, and Kaufmann 2000, 412). The *Tackling Climate Change* publication asks for safeguards "to avoid the potential negative side-effects of efficiency gains" in the form of poor welfare (Gerber et al. 2013, xiv). Throughout the hundred pages of the document, "animal welfare" is mentioned four times, mainly in relation to trade-offs with more efficient production (Gerber et al. 2013, xiv, 60, 88). The Global Agenda admonishes intensive agriculture to have met demand-led growth and concurrently neglected "other aspects of sustainable development, including animal welfare" (Global Agenda for Sustainable Livestock 2014b, 9), and pleas to "respect socially desirable outcomes that are not the immediate focus of Agenda-related activities" such as animal welfare, public health, or animal genetic diversity (Global Agenda for Sustainable Livestock 2016b, 6). The Agenda even advances a labeling scheme for improved animal welfare as a strategy for smallholders to diversify their products. Like that, markets can be created and expanded, according to the Agenda (Global Agenda for Sustainable Livestock 2014b, 5).

This instrumentalization of animal welfare for profit is consistent in all the scrutinized documents: *Livestock's Long Shadow* recommends that "improving animal genetics and minimizing animal stress (adapted brooding, ventilation and animal health measures) improves weight gain and, therefore, feed efficiency" (Steinfeld et al. 2006, 172). *Tackling Climate Change* treats "poor animal health" not as a welfare issue, but as an issue of lower herd productivity (Gerber et al. 2013, 73). Thornton argues that while there is "conflicting evidence as to the potential for adding value to animal products through higher welfare standards," "[i]mproving animal welfare need not penalize business returns and indeed may increase profits." (Thornton 2010, 2863).

247 In addition, the report mentions "the esteem that traditional stockraisers everywhere hold for their cattle" and the ambiguities of genetic engineering (Delgado et al. 1999, 43).

The higher returns on products from animal exploitation thanks to animal welfare labels are a prototypical win-win situation of ecological modernization. The problems are regulated, and in the end, there is even financial gratification from it. The system as such is not questioned or overturned. In a paper on animal captivity, Acampora ponders that the zoo reformer "wants the inmates to feel as comfortable, as snug, and as much at home as possible" (Acampora 2005, 109, quoted in Morin 2016, 2). The same can be said about animal welfare and "happy meat." The only reason to make the confined animals feel better is to make them more governable, controllable, compliant, and healthier, all of which guarantees their sustainable exploitation and generates higher returns. Garnett and Godfray observe the widely shared priority of animal health because of its economic benefits in the wider sustainable intensification policy field (Garnett and Godfray 2012, 35). Not surprisingly, in stakeholder partnerships, where big animal welfare organizations join large corporations and producers' organizations—the Global Agenda for Sustainable Livestock is a paradigmatic illustration –, greener production is advertised as a good bargain for producers.[248] They can focus on quality instead of quantity, and profit from a label which will "boost profitability by increasing margins" (MacMillan and Durrant 2009, 13).[249] Nevertheless, the only winner of such campaigns is, eventually, the animal industry which gets more returns, credibility, and the "license" to exploit even more farmed animals (Francione 2012, 257).[250] As a matter of fact, the market for "sustainable" animal foods with a welfare label is booming. Organic animal products promise attractive revenues: organic meat is on average twice as expensive as non-organic meat. The organic market has a lucrative outlook in India, Brazil and China.[251] In the Minority World, animal foods with a green or welfare label are an equally promising business. Still, the percentage of organic meat on the market is on average below two percent (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 47, 49).[252] This extremely low figure illustrates, first, that there is major growth potential, and second, that sustainable meat has an impressive discursive power. Whereas the Livestock Revolution has far-reaching repercussions, affecting the lives of millions of nonhuman and human animals, and, yet, gets relatively little attention, products like "happy meat" or "organic milk" with an animal welfare label are extraordinarily prominent and dominate the imagery of ads and supermarkets,

248 Typical cases are the "Livestock consumption and climate change—A framework for dialogue" report by the Food Ethics Council and the World Wildlife Foundation UK (MacMillan and Durrant 2009) or the "Reviewing the Costs: The Economics of Moving to Higher Welfare Farming" report by Compassion in World Farming (CIWF 2011).

249 However, van der Zijpp, Wilke, and Carsan (2010, 142) fear that strict animal welfare regulations in the Minority World may shift intensive production to the Majority World.

250 Moreover, meat producers are creating their own animal welfare standards, and the multiplicity of labels is both pacifying and distracting self-declared "ethical" consumers (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 47).

251 The organic market in India was worth 190 million USD in 2012. From 2012 to 2015, it had already boosted its sales to one billion USD (Heinrich Böll Foundation and Friends of the Earth Europe 2014, 49).

252 Jamieson and Stanescu estimate that in the United States, it is one percent (Jamieson 2008, 185–86; Stanescu 2013, 104).

notwithstanding their limited empiric occurrence. In addition, not only is the percentage of farmed animals reared in a "happy, sustainable way" minimal, their "happy" life nonetheless ends with being killed. And how exactly a "happy death" should look like is a neglected issue in the green discourse (Jenkins and Stanescu 2014; Stanescu 2011).[253]

Besides, "sustainable" meat involves all the usual, abhorring practices debated in chapter 2.2 and continued in the next paragraph, such as gassing male chickens at birth, specialized breeds that are prone to diseases, artificial insemination, continuous pregnancies, separating the mothers from their babies, and so on (Stanescu 2013, 103). In sum, not only do animal welfare labels and products like "sustainable meat" not fulfill their pledge, and thus instrumentalize their green label for generating profits, they additionally reform, naturalize, and legitimize animal exploitation in general.[254]

Steinfeld's comments on animal welfare violations and "real and suggested animal suffering" in "unregulated" intensified production, and the concerns those circumstances raise in "more affluent societies," are, albeit subtly, vilifying production and consumers in the Majority World as indifferent about animal welfare. The augmented yet "enlightened" sustainable exploitation of animals in the Minority World with its animal welfare standards is then an indicator of societal "advancement." Not only does Steinfeld represent the Minority World as more "progressive" or "civilized," he also conceals that violence and exploitation are the daily consequences of animal exploitation in "regulated" as much as in "unregulated" systems. It is animal production itself that innately forbids the "expression of natural behavioural features" Steinfeld laments. *Tackling Climate Change's* observation on animal welfare "side-effects" is a similar misrepresentation of "sustainable" animal exploitation. In the animal-industrial complex, capital is generated with animal exploitation, and the violence enacted on animals, those "side-effects," is the industry's very foundation.

5.5.2 Effects of sustainable intensification

> "Increased production can be derived by a combination of expansion in animal numbers and increased productivity, the latter being a compound of higher off-take rates (shorter production cycles by, for example, faster fattening), and higher carcass weight or milk and egg yields." (Steinfeld 2004, 28).

253 In an article on the discourse of Australian environmentalism, McGregor ponders: "The right to a humane death does not question the right of humans to kill/cull, instead it is the method of killing/culling that becomes central." (McGregor 2004, 600).

254 Stanescu offers an excellent critical analysis of the phenomenon—not only deconstructing the purported "sustainability" of these commodities, but also dismantling their speciesist and anti-emancipatory nature (2011).

With these sentences, Steinfeld mechanistically sketches what the Livestock Revolution signifies for farmed animals. The repercussions exist on a quantitative and qualitative scale: more animals will be exploited, though the exploitation additionally gets more extreme. The Revolution report specifies that the increase of livestock production in the Majority World in the 1970s to 1999 has largely originated in a higher number of animals, not in a higher carcass weight (Delgado et al. 1999, 2). Poultry is the fastest growing sector in the Revolution, and the proportion of beef is diminishing in the total output; in addition, the amount of meat "gained" from one chicken is far less than the amount of meat ripped out from a cow. These factors signify that the total number of animals killed for meat production might escalate by 2050, despite the productivity gains. Weis estimates that by 2050, global meat consumption will probably equal the deaths of almost 120 billion animals (Weis 2013b, 71).[255] He speaks of the "other population bomb," perhaps a true one this time: that of farmed animals (Weis 2010, 139).

The qualitative aspect of the Livestock Revolution is the industrialization of exploitation, or "livestock industrialization" (Delgado, Narrod, and Tiongco 2008). Life cycle assessment has shown that intensified settings emit less greenhouse gasses than extensive settings, which corresponds to the emission intensities discussed in subdivision 5.4.1. Consequently, Garnett and Godfray fear that "the goal of sustainable intensification will be used to justify systems of production that cause animal suffering" (Garnett and Godfray 2012, 35). Indeed, at least 75 percent of livestock production is estimated to take place in confined systems by 2030 (Thornton 2010, 2856). The shift from ruminants to monogastric species facilitates an industrialization of production. Nevertheless, not only monogastric species, more than half of cattle and sheep in the Majority World (with the exception of Sub-Saharan Africa) will be shut in by 2030, too (FAO 2005, 4). In general, the extremely brutal circumstances of industrial production explicated in chapter 2.2 on animals and violence will aggravate with the Revolution.

Nonetheless, sustainable intensification and exploitation have their own specificities. How do farmed animals experience the greening of their somber and bloody exploitation? One declared goal of sustainable intensification in the livestock sector is "to produce more, using fewer resources, with benefits to all," as the Global Agenda formulates (Global Agenda for Sustainable Livestock 2016c). More output should be created, with less input, but also with less emissions and less waste.

255 Thornton expects the standing global cattle population (not the slaughtered individuals) to grow from approximately 1.5 billion animals in 2000 to 2.6 billion animals in 2050, the global sheep and goat population from 1.7 billion to 2.7 billion in 2050, and the global pig population to grow from 1 billion in 2010 to 1.1 billion in 2030, but then to decrease to 0.95 billion in 2050. The global poultry population is forecasted to grow from 20 billion in 2010 to 34 billion in 2050 (Thornton 2010, 2856–2957).

Genetic selection is one strategy to render animals more productive (Shields and Orme-Evans 2015, 365), and Twine observes the so-called "molecular turn" to change animals' genomes to obtain more "ecological" animals (Twine 2010, 162). However, until genetic engineering engenders the desired result, countless "useless," "undesired" animals end up being dumped in the process—be it because of imperfections, commercial worthlessness or severely compromised health (Benz-Schwarzburg and Ferrari 2016, 30).[256] In the Majority World, traditional, local breeds that are adapted to local climate, predators, parasites, diseases, and feed, are replaced with highly productive European breeds such as the Holstein dairy cow that are not used to such conditions (Galal 2007; Shields and Orme-Evans 2015, 369). Yet, in the course of the Revolution, the effects of climate change will severely impair the health of grazing animals. They will suffer from heat stress and extreme weather events, they will be more susceptible to vector- or food-borne diseases, and less resistant to infections, and they will experience feed and water shortages, too (Nardone et al. 2010, 58; Thornton 2010, 2860). Laible claims that "relatively fast changes to the genetic make-up might be required" in order to "alleviate the effects and allow animals to adjust to the changed environmental conditions" (Laible 2009, 133). This reasoning is worrisome on several levels: the exploitation of farmed animals contributes to climate change, and the stress that those animals have to endure must be decreased by genetically altering them (which occasions the suffering and death of numerous useless generations) before they are going to be killed, which again will heighten greenhouse gas emissions.

Feeding practices are another tactic to sustainably intensify production. Adding more concentrates to feed for ruminants while decreasing the amount of forage is a common practice to decrease greenhouse gas emissions. In some cases, the percentage of concentrates rises up to 90 percent. This practice is called "finishing" in feedlots.[257] The consequences of adding more concentrates like grains are numerous. The cow's rumen is not used to this kind of food. Digestive problems provoke liver abscesses or foot disorder laminitis and ultimately account for a fourth of the mortality rate of cows in feedlots. Pigs' digestive systems are designed for high fiber food. Yet feed concentrates, in order to boost productivity and cut emissions, are low in fiber. Pigs develop gastric ulcers, which contributes to the mortality rate in pig feedlots. Feed additives can inhibit fiber digestion and even be toxic for the animals. Sulfate, for example, can cause sulphur induced *polioencephalomalacia*, a neurologic disease. In the United States, this disease is observed in cattle that are fed distiller grains, a by-product of the ethanol industry and

256 What is more, the primary studies in genetic engineering to "enhance livestock" and "increase animal welfare" are predominantly performed on mice. As common in vivisection, the supposed "welfare" of the recipients of the new technology is valued more than the welfare of the mere "lab instruments," the rodents.

257 In Brazil, the number of cows "finished" in such feedlots increased by 50 percent—from two to three million individuals—from 2003 to 2010 (Shields and Orme-Evans 2015, 364).

low-cost feed additive which has a high content of sulfate (Shields and Orme-Evans 2015, 364–65).

Not only human food, all sorts of waste and animal by-products, be it animal hair, bone or blood meal, fish meal, horn and hoof meal, leather or liver meal, milk permeate, rat meal, rumen contents, and even paper have reportedly been or are being fed to farmed animals (Feedipedia 2016). In the race for maximizing profit and minimizing expenditure, the industry invests in ways to convert waste into feed. One illustration is valkerase. Valkerase is a keratinase enzyme processing additive which has been developed to break down keratin in feathers, abundant in slaughterhouse waste. Valkerase makes feather meal more digestible. The feather meal is then fed to chickens (Torres 2007, 65). Housefly maggot meal is another example of converting waste into feed. Housefly maggots are grown on litter and are then fed as an additional protein source. "Housefly larvae are able to break up and dry out large amounts of poultry manure, and this ability makes them a potential solution to waste management in poultry farms," write Heuzé and Tran of *Feedipedia* (Heuzé and Tran 2015). Hatchery by-product meal is another way to recycle the nutrients in hatchery waste:

> "Hatchery by-product meal results from the processing of poultry hatchery wastes, such as shells of hatched eggs, infertile eggs, dead embryos and dead or culled chicks […]. World poultry production, including chickens, ducks, turkeys, geese and guinea fowl was 55.5 billion head in 2009 […]. It can be estimated from this figure that 0.8 to 3.3 billion tons of hatchery wastes are generated every year, using an hatchability value of 50-80% […], and an average egg weight of 60 g." (Heuzé, Tran, and Chapoutot 2015).

In other words, the immense population of poultry generates a similarly colossal amount of "waste" or deaths. For the industry, it is clear that converting those "by-products" into feed is a profitable, and even "environmentally friendly" method to deal with non-economic side-effects:

> "High nitrogen losses result in enrichment of ground water, lakes or rivers, pathogen distribution, production of phytotoxic substances, air pollution and greenhouse gas emissions. Over-application of organic waste as fertiliser for cropping can result in nitrate (NO_3) contamination of groundwater […]. Processing hatchery wastes into animal feeds is a way to alleviate this environmental concern" (Heuzé, Tran, and Chapoutot 2015).[258]

258 The FAO feed encyclopedia actually deplores that feeding hatchery by-product was once banned in the European Union: "Like other animal by-products, the use of hatchery by-products for animal feeding is often regulated and even prohibited in certain countries due to concerns over the transfer of pathogens […]. In 2002, due to public health concerns following the BSE crisis, hatchery by-product meal was banned in the European Union for farm animals but remained authorised for pet food […]. This ban was lifted on March 4, 2011 and hatchery by-product meal is again allowed for livestock feeding in the European Union" (Heuzé, Tran, and Chapoutot 2015).

Reducing waste is not the only strategy of sustainable intensification if it comes to feed management. The industry is struggling to find a balance between maximal growth rates and feed conversion by the animal on the one hand, and minimal nutrient input on the other hand. The nutrient input must be minimized because corporations have a financial incentive to comply with environmental regulations and circumvent fines for pollution. An effect of this instrumental reasoning and minimal nutrient input is that the animal's bones are too weak to bear her or his weight and fast growth; they easily break during transportation and slaughter, flawing the carcass and lowering profits (Clark 2012). Consequently, bone integrity is another factor that has to be considered in the development of so-called "environmental nutrition." Environmental nutrition was originally defined as

> "the concept of formulating cost-effective diets and feeding animals to meet their minimum mineral needs for acceptable performance, reproduction, and carcass quality with minimal excretion of minerals" (Kornegay and Harper 1997, quoted in Clark 2012, 110).

In the FAO jargon, the trade-off is characterized as follows:

> "This can be achieved by […] synchronizing nutrients and mineral inputs to the animal's requirement […], which reduce the quantity of manure excreted per unit of feed and per unit of product" (Steinfeld et al. 2006, 171).

Clark accurately observes that this diet is not adjusted to the needs of the animal but solely to the "needs of capital" (2012, 109). Accordingly, he frames these new developments as "environmental violence," a term which traditionally has been used to denote the "culling" of unwanted species. Here, it is applied for the creation of new forms of oppressed animal life. This violence on animal subjects is justified with the ecological impact that results from their "unsustainable" exploitation (Clark 2012, 111, 119).[259] Environmental violence thus contributes to rendering exploitation sustainable.

5.6 Demand and supply for the Livestock Revolution

The Revolution authors contend that the Livestock Revolution is demand-driven, in contrast to the Green Revolution, which was supply-driven. This dominant storyline has been reverberated in a plethora of publications. What is more, governments and development agencies follow the lead and take the Revolution for granted (Rivera-Ferre 2009, 92). The following paragraphs de-

259 The Global Agenda acknowledges this, depicting violence as "detrimental co-effects": "GHG mitigation technologies may come at a cost to animal welfare and other environmental variables; and practices and technologies that have beneficial rather than detrimental co-effects should be favored." (Global Agenda for Sustainable Livestock 2014b, 6).

construct this assertion. First, it is investigated why curbing this demand, given the environmental impact of the Revolution, is not an option. Second, it is shown how the countries with the most pronounced growth in consumption are congratulated and countries lacking such growth are pitied. Such appraisals for the Livestock Revolution provoke the question: who has an interest in furthering it? Third, the dichotomy demand versus supply is examined. In the fourth and fifth section, the focus is on the material circumstances fueling the Revolution, including imports and enabling technological and institutional conditions. This is by no means an exhaustive agroeconomic investigation. Rather, the chapter carves out discursive fragments on the necessary supply and conditions for the livestock industrialization that are only mentioned in passing, and otherwise remained hidden. Such a deconstruction crashes the Revolution's fated and inexorable façade: the Revolution becomes contingent, a question of interests, of power. In this light, the refusal to discuss mitigation measures to curb demand becomes comprehensible, as well.

5.6.1 Reducing demand is not an option

The Livestock Revolution discourse assumes an upsurge in the consumption of animal protein in the Majority World; in the Minority World, conversely, the growth is expected to be far less pronounced. A cheap and effective mitigation strategy for the environmental impact of the sector, and one that would simultaneously lessen animal suffering, would be to diminish the consumption of livestock products in places where it has already reached excessive levels in the second half of the twentieth century, primarily in the Minority World. This strategy tackles the demand side, not the supply side. However, in the hundreds of pages written on the subject matter, curtailed consumption of animal protein or vegetarianism—let alone veganism—are blatantly absent. The 1999 Revolution document does not name vegetarianism once. *If* vegetarianism is mentioned in subsequent publications, its theoretical mitigation potential is acknowledged yet deemed unrealistic. The World Bank's report on the Livestock Revolution, for example, estimates: "Obviously, except for very radical solutions, such as prohibiting livestock production, there is no 'silver bullet' for solving these [environmental] problems" (World Bank 2005, x). In other cases, the mitigation potential of lower meat consumption is presented as populist, one-dimensional, or exaggerated:

> "Human dietary preferences, along with many other factors, may change the current patterns of land use systems, but discussion of the implications of those changes needs to be more sophisticated than popular generalizations about reducing meat consumption" (Herrero and Thornton 2013, 20878).

> "Recent high-profile calls to flock to the banner of global vegetarianism, backed by exaggerated claims of livestock's role in anthropogenic global greenhouse gas emissions, serve

> mostly to highlight the need for rigorous analysis and credible numbers that can help inform public debate about these issues" (Thornton 2010, 2863).

Livestock's Long Shadow concludes, however, that a decreased consumption of animal products in the Minority World could "significantly reduce" the environmental damage by livestock (Steinfeld et al. 2006, 269) and lists the "tendency towards vegetarianism" as a reason for optimism (Steinfeld et al. 2006, 276). On the other hand, it maintains that "[a]ttempts to curb the booming demand for [animal] products have generally proved ineffective" (Steinfeld et al. 2006, 4), albeit without further explicating those attempts. In 2013, *Tackling Climate Change* resonances this appraisal and adds the expected health benefits for regions with very high intake of animal proteins. Further, this "important" mitigation method is "relatively low cost" (Gerber et al. 2013, 45). The authors equally acknowledge the low efficiency of animal protein (Gerber et al. 2013, 1). Despite this evidence, the authors do not justify their sole focus on the supply-side by increasing productivity with a single word. Similarly, in all its publicly available documents, the Global Agenda makes one sole statement on reducing consumption: "There is also increasing debate about the mitigation impacts that may be derived from changes in demand." (Global Agenda for Sustainable Livestock 2014b, 6). The Agenda then quotes the Intergovernmental Panel on Climate Change's Fifth Assessment Report of 2014 (Smith et al. 2014) (compare part 2.3.1).

Exemptions in the almost complete dismissal of reducing consumption in the discourse are the articles Herrero et al. 2009 and Thornton, Herrero, and Ericksen 2011. Here, lowering the demand of animal foods in the Minority World, while meeting demand in the Majority World with "sustainably intensifying systems," is mentioned as the *first* mitigation option (Herrero et al. 2009, 112, 117; Thornton, Herrero, and Ericksen 2011, 2).[260] Overall in the Livestock Revolution discourse, only representatives of social justice or animal rights organizations consequently monitor the salient lack of tackling the consumption side. Shields and Orme-Evans from the non-governmental organization Humane Society International write in their article "The Impacts of Climate Change Mitigation Strategies on Animal Welfare" that "production-side efficiency approaches seem, in some ways, to avoid the heart of the problem" (Shields and Orme-Evans 2015, 378). A Well-Fed World, a non-governmental organization campaigning against hunger and animal exploitation, asks to "reverse" the Revolution and lower meat consumption in the Minority World (AWFW 2016).

260 To illustrate: "*Reduce the demand for livestock products:* Consumption of livestock products per capita has increased in the developed world, and levels of consumption in some countries increase the risk of health problems. Here, demand is met by local production in very intensive systems or by import of livestock products. In both cases, this demand affects land use practices and use of resources in the developing world. Reducing the demand for livestock products in the developed world could lead to healthier people and reduce pressures on land and natural resources in developing countries." (Thornton, Herrero, and Ericksen 2011, 2 [original emphasis]).

5.6.2 Laudation of the Revolution

Those rare exceptions prove that the sector is *supposed* to grow, and its expansion is not to be decelerated. The sole measure necessary is to internalize the "social and environmental externalities," the "collateral damage" of the Revolution. This blind acceptance of the Livestock Revolution and even its encouragement are recurring elements in the discourse which praises the regions spearheading it. The International Livestock Research Institute calls China and India "Asia's star performers," and Steinfeld and Chilonda laud the" booming" Indian poultry industry and the "impressive growth" in the Chinese livestock sector (Steinfeld and Chilonda 2006, 13). *Livestock's Long Shadow* congratulates countries in Latin America for having "successfully expanded their domestic feed base, taking advantage of the low production costs and abundance of land. They have moved to adding value to feed, rather than exporting it" (Steinfeld et al. 2006, 16).[261]

In a similar vein, the publications criticize the low level of consumption in other regions of the Majority World which "leaves a significant potential and need for increases." (Steinfeld 2004, 21–22). The International Livestock Research Institute pities Sub-Saharan Africa's "poor performance" which reflects "its poor overall economic performance" (ILRI 2000a, 5–6). In this region, consumption levels of animal protein "have not only been low, but have remained static and even declined over the last decade," according to Steinfeld and Chilonda (2006, 11). In Latin America and the Caribbean, in 2004, "meat consumption per caput is still at about 60% of that of industrialised countries, implying that there is scope for further growth." (Steinfeld 2004, 22). Likewise, meat consumption in South Asia is "still very low" (Steinfeld and Chilonda 2006, 10).

> "Moreover, in many developing countries, where the need to increase protein consumption is greatest, the productive sector has not participated in the 'livestock revolution.' For instance, there are still about 20 developing countries where per capita meat consumption is below 10 kg/year, compared with an average of 80 kg/year in developed countries. Cultural or religious reasons may explain this feature in some countries, but low productive capacities are, by and large, the main cause in many" (FAO 2013, 142).

These cultural explanations for a lower consumption are met with reluctance and almost frustration: The International Livestock Research Institute deplores that lactose intolerance in East Asia, vegetarianism in South Asia, and Muslim beliefs "everywhere" "curb demand" or "depress consumption" (ILRI 2000a, 6).

261 The described "land abundance" refers to the Brazilian Cerrado and Mato Grosso region (Steinfeld and Chilonda 2006, 11); the Cerrado region in particular is a highly biodiverse region (Fritz 2014, 6). No word is lost about the ongoing deforestation and biodiversity loss.

5.6.3 Supply versus demand

The storyline of the demand-driven Livestock Revolution conveys the image of an anonymous, ever-increasing, powerful mass of consumers yearning for animal protein—an unstoppable occurrence in the natural course of human history. Nevertheless, supply and demand are not rigid economic variables, they are social events embedded in material conditions. To reduce the advent of such drastic structural changes in global agriculture to a mutually exclusive dichotomy of supply and demand is rather simplistic.[262] The demand-side dogma indicates that there is something such as "consumer sovereignty;" a truly naïve view in the industrial meat regime and the broader, capitalist economy where corporations shape people's wants and needs (MacLachlan 2015, 27; Rivera-Ferre 2009). The meagre "choices" consumers dispose of are always already constrained and constructed by decisions taken before the product even reaches the (supermarket) shelf (Parker 2013). Hence, the idea of changing the politics of production through consumer choices—the power to "vote with the fork"—is misleading.[263]

Rivera-Ferre's paper from 2009 is one of the few special cases investigating the driving forces behind the Revolution and breaking the link between the "rising demand" and the "need for intensification." She argues that an upsurge in demand is a result of cost externalization and supply increments. This combination on the supply-side then lowers product prices and changes consumer habits and is a principal reason for increasing consumption. In fact, prices for animal products have declined more than prices for other food (Rivera-Ferre 2009, 93–94). The cheapest livestock products, mainly poultry, witnessed also the biggest growth in consumption. Livestock production that could not profit from vertical integration, industrialization and economies of scale, such as beef production, remained relatively expensive (Rivera-Ferre 2009, 95). The focus on lower prices is also not to be confused with the Revolution's alleged cause, higher income. The first concentrates on the suppliers and therefore on structures, and the second focuses on the consumers. Accordingly, Rivera-Ferre maintains that economic and political factors favoring transnational corporations, industrial systems, geographic concentration, and economies of scale triggered the Livestock Revolution (Rivera-Ferre 2009, 96). In addition, international institutions such as the World Bank have supported and funded the evolution of industrial production systems (Rivera-Ferre 2009, 99). Rivera-Ferre:

262 The Green Revolution took place in the 1960s, with ongoing famines particularly in Asia. The hungry, from a strictly economic standpoint, do not represent a "demand" because they lack the capital to materialize that demand (compare the section on food security 5.7.3). Still, new strategies and technologies to heighten agricultural productivity were not developed in a vacuum. The race for profit and the combat against hunger by governments were motivations that incited the Green Revolution (Sumberg and Thompson 2013, 7).

263 Still, in "The Livestock Revolution—A Global Veterinary Mission," Steinfeld attributes consumers with the authority to influence the market and environmental regulations:
"Concerns about the long-term productivity of natural resources, including land, water and air will not be reflected in market prices unless consumers demand it and unless the public and private sector respond by defining and establishing mechanisms that correctly reflect the present and future value of natural resources." (Steinfeld 2004, 35).

> "It is obvious then that the increasing demand of meat and fish is not an inevitable process simply associated to urbanization or higher incomes, but a political and economical [sic] process conducted largely by agencies and institutions (and supported by some researchers) promoting a global development model within the neoliberal capitalist paradigm in their search of maximizing monetary benefit. In the case of meat and fish, this is reflected in the promotion of the intensive production systems." (Rivera-Ferre 2009, 100).

The article "Underneath the Livestock Revolution" by the FAO authors Costales, Gerber, and Steinfeld, similarly discusses the Revolution's structural underpinnings (Costales, Gerber, and Steinfeld 2006). The authors point out that change in the sector occurs in regions where there is "sufficiently high demand," but also where economies of scale can be exploited, and where foreign direct investment facilitate the expansion (Costales, Gerber, and Steinfeld 2006, 24–25, compare equally Delgado, Narrod, and Tiongco 2008). Very fundamentally, the "entry of transnationals into the agri-food chain […] has transformed the manner in which agri-food products are purchased from suppliers, transformed into differentiated products, and distributed to consumers." (Costales, Gerber, and Steinfeld 2006, 17).

Apart from occasional remarks, the discourse remains relatively silent on supply-side changes that enabled the Revolution. The Revolution authors mention that price changes heighten consumption (Delgado et al. 1999, 6); however, they do not elaborate on its implication and causation.[264] Both Delgado and Narrod 2002 and Steinfeld 2003 suggest that the Revolution might be as supply-driven as it is demand-driven (compare Rivera-Ferre 2009, 93–94). In 2002, the International Livestock Research Institute claimed that markets create demand (ILRI 2002, 7), and in 2011, Narrod, Tiongco, and Scott from the International Food Policy Research Institute maintained that the Livestock Revolution "is both demand and supply driven." (Narrod, Tiongco, and Scott 2011, 1).

In sum, the Livestock Revolution equals a whole mode of consumption *and* production that is occupying and intruding on the Majority World. MacLachlan frames it as the "agro-industrial model based on economies of scale and the integrated industrial-grain-oilseed-livestock complex" (MacLachlan 2015, 36). Schneider proposes the industrial meat regime. This thesis suggests the image of "imperial meat." The Livestock Revolution discourse's reference values like progress and modernization that can create and legitimize a demand, or, differently put, the val-

264 A typical case:
> "With notable exceptions for milk and poultry in the developed countries, where technological progress arguably preceded and precipitated changes in demand through lower prices, the supply side of the Livestock Revolution until now has mostly responded—often under distorted incentives—to rapid increases in demand." (Delgado et al. 1999, 59).

ues that symbolically drive the Revolution are discussed in subdivision 5.7.1. On the material side, the agro-industrial model necessitates, among other factors, fertilizer, feed, farmed animals, appropriate technology and infrastructure including the retailers that sell the products. The weight of such retailers cannot be underestimated. Costales, Gerber and Steinfeld explain that supermarkets not only respond to, but also shape demand (2006, 15). In addition, the vertical integration of production is indispensable, as are enabling political and economic conditions like foreign direct investments or the liberalization of the retail and trade sectors (for instance, by lowering tariffs and quantitative restrictions). Due to the hegemony of the Minority World in the animal-industrial complex, the Majority World is dependent on the Minority World for a certain segment of those factors and inputs (Garcés 2002, 7).

5.6.4 Necessary imports

One crucial input for the Revolution is animal feed. The International Livestock Research Institute writes that the Revolution literally "will suck in" imported cereal, and these imports will chiefly stem from the Minority World (ILRI 2000a, 7). As most of Asia and Africa "lack the capacity to produce substantial amounts of feed grain at competitive prices," they will import more grains in the future or have to intensify their existing land resources (Delgado et al. 1999, 20). Nevertheless, not only the necessary feed, but livestock products as such will be and are already being imported (Guyomard, Manceron, and Peyraud 2012; Hoffmann 1999; Steinfeld et al. 2006, 17). Projections anticipate that domestic production in the Majority World will not keep up with demand for animal protein (FAO 2005, 3), especially in East Asia and Africa (AGTR 2011). Countries in the Majority World will be import leaders, whereas countries in the Minority will be export leaders, with the exceptions of Southeast Asia for pork and chicken, and Latin America for beef (Hall, Ehui, and Delgado 2004, 428–29; Narrod, Tiongco, and Scott 2011).[265] Net imports of meat products are predicted to increase by 131 percent by 2030; net imports of dairy products might expand by 96 percent (FAO 2005, 3).

Who profits from those imports? When it comes to animal feed, the main exporters of wheat are the United States, the European Union, Canada, Australia, and Russia. The United States, Brazil, and Argentina are the biggest maize and soybean exporters. The global dairy market is dominated by the players European Union and New Zealand. The top meat exporting economies are the United States, the European Union, and Brazil.

Several countries forward their export-sector because domestic demand is stagnating. The European Union, for example, has difficulties selling poultry to its citizens. European consumers prefer fresh chicken breast; the rest of the chicken is hard to vend. Hence, the

265 Countries in the Majority World had already become net importers of meat products in the 1980s; the importation of milk and dairy products began even earlier (FAO 2005, 3).

chickens are cut into pieces, frozen and exported. The earnings from the European markets subsidize this trade. EU-27 chicken meat exports rose form 690,000 tons to 1.4 million tons from 2006 to 2012. France, Germany, and the Netherlands are the central poultry exporting countries. Africa is the destination of a third of EU broiler exports.[266] These cheap exports—the frozen pieces are sometimes sold at half the local price—tend to destroy local production. African countries, on the other hand, have difficulties restricting imports because of trade liberalization agreements (Fritz 2014, 10–11).

In general, an economy based on imports is much more vulnerable to global market shocks and price hikes (Garcés 2002, 8). The dependency on imports is particularly unfavorable to the Majority World due to the imports' foreign exchange costs and the overall prominence of the agricultural sector (Upton 2000, 4). Narrod, Tiongco, and Scott from the International Food Policy Research Institute indicate that stringent safety requirements for animal foods in fact make "it almost impossible" for countries in the Majority World to export their products (Narrod, Tiongco, and Scott 2011, 2). A look at this profit distribution sheds a different light on the purported "need" or inevitability of the Livestock Revolution.

5.6.5 Necessary conditions

Technology, infrastructure, and political and economic conditions are further necessary ingredients for the Revolution. In close reading, paragraphs in the Revolution report demonstrate how the Minority World not only exports feed, but industrial technology and facilities, as well:

> "In the developed countries, technological progress for both ruminants and monogastric animals involved reproductive and genetic technology, including advances in biotechnology; feed improvement through blending, processing, genetic means, and chemical treatment; use of growth hormones; and improvements in animal health maintenance. Some of these industrial technologies, especially for pigs and poultry, have been fairly easily transferred to developing countries." (Delgado et al. 1999, 63).

> "In the next 20 years the transfer of meat and milk processing technology to developing countries by the private sector under public regulation is likely to be especially important for food production. […] The establishment of dairy plants and slaughterhouses in producing areas, together with market development, will play an important role in stimulating market-oriented production." (Delgado et al. 1999, 55).

266 Delgado et al. explain how livestock products from the Minority World were already "dumped" in the 1970s and 1980s in Sub-Saharan Africa (Delgado et al. 1999, 19). Currently, Smithfield's frozen pork produced in Eastern Europe is exported to Liberia, the Ivory Coast, and Equatorial Guinea and sold at almost half of the local market price (Carvajal and Castle, May 05, 2009).

In 2004, Steinfeld even speaks of the “wholesale transfer” of production systems:

> “The wholesale transfer of these types of production systems has been facilitated by the relative ease and speed with which the required infrastructure and equipment can be transferred and operationalized in so-called ‘turn-key’ operations.” (Steinfeld 2004, 31).

So-called “turn-key operations” are supplied facilities that are ready for immediate use. In 2011, Narrod, Tiongco, and Scott maintain that “most of the technology” for the Revolution “has been developed by the private sector and transferred to developing countries.” (Narrod, Tiongco, and Scott 2011, 1). Steinfeld and Chilonda explain that the livestock industrialization—in particular poultry production—is essentially not an “organic”, but a discontinuous event: “as soon as urban markets develop, investors step in, often with no previous association with livestock production, and establish industrial type units and associated processing and marketing methods” (Steinfeld and Chilonda 2006, 9). The private sector is the driving force in spreading such operations in the Majority World:

> “The private sector, therefore, will continue to play the leading role in further livestock technology development and diffusion in developed-country industrial systems. Industrial technologies for pigs and poultry are largely transferable to developing countries, suggesting that the need for public goods provision for these items is modest. The problem is that technology development and extension are also required for cattle and other types of livestock production. The role of the public sector becomes an issue here, especially in developing countries, where large private companies rarely operate outside the industrial livestock sector.” (Delgado et al. 1999, 64).

Here, Delgado et al. do not mince words when describing the dominance of the private sector in the Livestock Revolution. In point of fact, transnational business is the protagonist in the expansion of the animal-industrial complex, aided by the public sector. Nonetheless, in the discourse of the Livestock Revolution, the dominance of the private sector remains concealed, and a demand by anonymous masses in the Majority World occupies center stage.

Costales, Gerber, and Steinfeld sketch how transnational corporations, in order to expand their market share, are constantly trying to cut the costs of production. They tend towards vertical coordination, which means that retailers contract primary producers and processors. Henceforth, they control all stages of production, processing, and distribution. Differently put, such a “fully integrated system” implies that one sole food corporation owns all different units in the food chain, applying its uniform food quality and safety standards. Through vertical coordination, efficiency can be boosted and economies of scale exploited (Costales, Gerber, and Steinfeld

2006, 17–18; Delgado, Narrod, and Tiongco 2008; Steinfeld et al. 2006, 20). Foreign direct investment is crucial for the giant retailers:

> "The entry of [foreign direct investment] allowed transnational food retailing companies to bring with them their state-of-the-art technology in product specification, quality control, labeling and packaging, as well as in logistics and accompanying infrastructure in procurement and distribution. From these investments are built the economies of scale and the capacity to meet competitively price and quality standards in both international and domestic markets […]." (Costales, Gerber, and Steinfeld 2006, 16).

Still, foreign direct investment needs advantageous policies by the government in question. Other favorable factors for the spread of transnational food agribusiness conglomerates are multilateral trade and retail sector liberalization, "the breaking down of quantitative restrictions and lowering of tariffs, and the laying down of rules and standards for food quality and safety." (Costales, Gerber, and Steinfeld 2006, 16). Steinfeld and Chilonda observe that governments support the creation of intensive, privately owned, "more efficient animal protein operations" in order to move away from "traditional" backyard production (2006, 7). This approach has been labeled "smallholder pessimism" (Jabbar 2004, 12). Waldron et al. (2007) and Rae (2008, 292) outline how state intervention in favor of industrial facilities was crucial for the Livestock Revolution in China.

Taken together, the aggressive expansion of large retailers and agribusiness since the 1990s has a momentous—and perhaps even revolutionary—impact in the Majority World (Thornton 2010, 2854):

> "The emergence of supermarkets in developing countries reflects a structural change that alters the way in which meat and dairy products are assembled, inspected, processed, packaged, and supplied to consumers. It is a change that has deep impacts on livestock and milk producers, particularly on who can and who cannot participate in the mainstream supply chains. A segmentation of markets can be seen, between the 'formal' and the 'informal' supply chains, and between the 'wet' markets for fresh and warm meat and the supermarket outlets of processed, frozen, packaged and branded meat. The relative significance of each market segment is tied to the level of economic development. […]
>
> While the informal supply chains for livestock and raw milk, and the wet markets for meat, still constitute the dominant segments in developing countries, with the expansion of their economies, the large scale retail sector is growing. […]
>
> The rapid expansion of large retailers in Latin America, East Asia and the Near East has been accompanied by a relative decline of traditional wholesale markets in regions where

> the restructuring of the agri-food markets and industries have been most dynamic." (Costales, Gerber, and Steinfeld 2006, 16–17).

Conversely, in regions where this restructuring has not been as "dynamic," informal markets dominate the sector, and production is oriented towards "home consumption" (see also Parthasarathy Rao, Birthal, and Ndjeunga 2005). Costales, Gerber, and Steinfeld write that for instance "most of Sub-Saharan Africa has not yet experienced a substantial take-off of supermarket diffusion." (2006, 17). However, the future of informal markets is uncertain:

> "The resilience of informal markets is apparently providing relief to small livestock producers supplying informal markets in the rural as well as urban areas on the basis of strong consumer preferences for traditional products. There are, however, no guarantees that these markets will continue to be the locus of economic opportunities for smallholders in the longer run. While consumption patterns and habits appear to be embedded in tradition, the power of structural change in modern market chains to overcome seemingly immutable hurdles cannot be underestimated." (Costales, Gerber, and Steinfeld 2006, 17).

There is even a parallel evolution of "supermarket penetration" and foreign direct investment: the lowest foreign direct investment took place in Africa, and South Africa, whereas Latin America and East Asia, except China, were the regions with the highest foreign direct investment in the 1990s (Costales, Gerber, and Steinfeld 2006, 16).

PART B NATURALIZING CONTROL AND CAPITALISM

5.7 Legitimization of the Revolution

There are only a few texts in the Livestock Revolution discourse that do *not* begin with a statement on the considerable surge in the demand for food of animal origin in the next decades. Accepting the natural and unavoidable occurrence of the Revolution is the premise of almost every paper. The sector is harmoniously depicted as a constitutional part of human history and natural cycles. The FAO's Committee on Agriculture portrays the livestock sector as

> "serving human needs while affecting natural systems. Livestock systems have developed over millennia and are continuously adapting to very diverse conditions. Livestock use natural resources (land, water, biodiversity, forests, fish, nutrients and energy) and environmental services and transform them into agricultural products (food, feed, fibre, manure, traction) that serve not only immediate needs but also provide economic and social services (food security, economic growth and poverty reduction, health and cultural value)." (COAG FAO 2016, 6).[267]

Referring to the Sustainable Development Goals, the Agenda partners recognize "the role of the livestock sector in promoting peaceful and inclusive societies" (Global Agenda for Sustainable Livestock 2016e). The industrial, (bio-)technologized, mechanized, and similarly destructive, violent, and colonial character of the complex is concealed here. With limited exceptions,[268] the rights of indigenous peoples, so deeply disregarded by the sector, never merit a line, nor does the tribulation of workers in the animal-industrial complex (compare the section on the social consequences of the animal-industrial complex, 2.4)—not to speak of the unimaginable violence farmed animal have to endure (outlined in chapter 2.2).

Next to the first premise of the Revolution's unavoidable occurrence as part of human evolution, a second premise often evoked in the first sentences of papers on the Revolution is the socio-economic, nutritional, and environmental importance of livestock. Even publications problematizing the sector's environmental impact cling to the storyline that livestock is an indispens-

267 This paragraph is from the agenda item Global Agenda for Sustainable Livestock at the COAG Session in September 2016. The machine-like and functionalist depiction of "livestock" in the quotation is worth noting.

268 The Global Agenda exceptionally observes that uneven growth favoring industrial systems and poverty "may contribute to a further erosion of the rights of indigenous people" (Global Agenda for Sustainable Livestock 2014b, 5). This declaration is without precedent, as is: "For stakeholder dialogue to be effective, meaningful and fair, it should be underpinned by science-based evidence, complemented as necessary by traditional knowledge." (Global Agenda for Sustainable Livestock 2014b, 12). Similarly, in a 2016 document, the Agenda mentions the "occupational hazards" and the "high rate of child labour" in the sector for the first time ever (Global Agenda for Sustainable Livestock 2016g).

able resource for humans (Herrero et al. 2009, 111).[269] For instance, after illustrating the contribution of industrial livestock systems to climate change, Herrero from the International Livestock Research Institute and his co-authors write that

> "However, livestock are not bad everywhere. In smallholder crop-livestock and agro-pastoral and pastoral livestock systems, livestock are one of a limited number of broad-based options to increase incomes and sustain the livelihoods of people who have a limited environmental footprint. GHG emissions from livestock and their impacts are relatively modest when compared with the contribution that livestock make to the livelihoods of hundreds of millions of poor people." (Herrero et al. 2009, 117).

Herrero et al. not only evade and distract from the seriousness of the ecological crisis. They also make an argumentative move that is common in the Livestock Revolution discourse and essential for the naturalization and justification of the Revolution as such. They use the "livelihoods of the poor" as a justification for the emissions of industrial production that actually *erode* those very livelihoods. Similarly, the image of organic livestock products legitimizes CAFOs, as elucidated in section 5.5.1.

In the following, these arguments and storylines that naturalize the Livestock Revolution are scrutinized: first, the notion of progress and modernity, second, the meaning of the Revolution for the poor, third, its meaning for food security, and, finally, its value for the environment. In terms of methodology, the storylines and underlying reference values of the Revolution discourse are first laid out and illustrated with paradigmatic quotes, and then, in a second run, examined and contrasted with efforts to naturalize capitalism, and its distractions from power structures.

5.7.1 Modernization

> "The Livestock Revolution is propelled by demand. People in developing countries are increasing their consumption from the very low levels of the past, and they have a long way to go before coming near developed country averages." (Delgado et al. 2000, 2).
>
> "Widespread evidence exists that as societies grow wealthier they substitute higher-priced livestock calories for lower-priced starch calories, at a decreasing rate as the substitution proceeds." (Delgado et al. 1999, 61).
>
> "[C]onsumption patterns in developed countries are an indication of where developing countries are going" (Delgado et al. 1999, 2).

269 "Livestock systems have often been the subject of substantial public debate, because in the process of providing societal benefits, some systems cause large quantities of natural resources and also emit significant amounts of greenhouse gases." (Herrero et al. 2009, 111).

Throughout the Revolution report, the increase in the consumption of animal products is portrayed as an inevitable, natural evolution in the course of "modernization" and "progress." This storyline insinuates that all societies develop in the same way, as if they were a plant, a natural organism, or as if they were the ideal-type of a child. In this generational view of the "human family," "developed" countries are the adults and "developing" countries the children. The child (the "developing" country) goes through linear stages of development. Its youth is defined by deficiency—not enough meat, not enough sophisticated technology, not enough growth. As the FAO-experts Steinfeld and Chilonda note, "the absence of sustained economic growth also explains why some countries, notably in sub-Saharan Africa, have not yet entered the 'meat phase'" (2006, 5). Nevertheless, with the right education, stimulation, and inputs, such as foreign investment, access to global markets, and environmental regulations, the "child" can reach adulthood. Africa is pictured as a particularly "bad pupil" in sector performance: the continent "has lagged behind in the development of the livestock revolution," according to Steinfeld and Chilonda (2006, 11). Still, the Majority World is "currently engaged in a catching-up process" (Steinfeld et al. 2006, 10), according to *Livestock's Long Shadow*. The goal of the race is the "convergence of diets:"

> "[L]ivestock consumption patterns in developing countries are rapidly converging with those in developed countries" (Delgado et al. 1999, 36).
> "[W]e observe that diets converge globally. Cultural peculiarities become increasingly blurred as demonstrated by the surge of poultry consumption in South Asia. These changing patterns are further supported by the fact that the same eating habits, such as fast and convenience food, are catching hold almost everywhere" (Steinfeld et al. 2006, 17).

A metaphor similar to the "convergence of diets" is the "nutrition transition," a rapid shift from undernourishment to diets richer in animal protein, pre-processed foods, sugar, fat, and alcohol. The caloric importance of "traditional staples" like cassava, potatoes, sweet potatoes, plantains, and various roots has been steadily declining since the 1960s (Steinfeld 2004, 21). This transition frequently ends up in overnutrition, reduced physical activity, and the upsurge of diet-related diseases like heart disease or hypertension (Steinfeld et al. 2006, 10). Despite those rather detrimental effects, moving up the "protein-ladder" is labeled not only as a sign of "progress," it also promises further economic growth.[270] In this same vein, Steinfeld writes that "developed nations" should provide "developing nations with an opportunity to export and grow their way

270 Costales, Gerber, and Steinfeld praise the Livestock Revolution for not only benefitting people, but also their livestock: "While large parts of the developing world are moving up the food chain, enjoying a richer and more diverse diet, so are livestock; traditional fibrous and energy-rich feed stuffs are in relative decline, and protein-rich together with sophisticated additives that enhance feed conversion are on the rise." (Costales, Gerber, and Steinfeld 2006, 23).

out of poverty" (Steinfeld 2004, 36). The Global Agenda equally believes in the "critical development functions" of the sector (Global Agenda for Sustainable Livestock 2014a).[271]

The "Livestock Revolution," the "nutrition transition," "convergence of diets," the race up the "animal protein ladder"—these metaphors are all development and modernization narratives (Sumberg and Thompson 2013, 18; Weis 2010, 142). The social is ecologized, and hegemony is naturalized: diverse continents and cultures are put on a uniform, unidirectional, meat-centered modernization ladder with the Minority World's society on top. The "nutrition transition" is presented as a law of nature (Schneider 2014, 616). Animal-based nutrition is globally promoted as a "superior diet" and a marker of modernity, progress, economic growth, "class ascension," and "Western" lifestyle (Weis 2013a, 70).[272] Merriam Webster defines "convergence" as "moving toward union or uniformity," and "independent development of similar characters (as of bodily structure of unrelated organisms or cultural traits) often associated with similarity of habits or environment" (Merriam-Webster Dictionary 2016). Yet, the Livestock Revolution is neither "moving toward union," nor is it an "independent development." The ongoing change in the Majority World is not a convergence, but a guided process in which powerful players have a vested interest to align global diets to the outlier consumption patterns of the Minority World of the late twentieth century. As shown in chapter 2, the Minority World's diet is both historically and spatially unique; it belongs to a specific time and a specific place. Statistically speaking, the Minority World's diet is the outlier, not the average; it is the anomaly, not the norm. Still, the Revolution discourse naturalizes this situated experience of a small fraction of humanity and thereby universalizes an imperial mode of living. For instance, *Livestock's Long Shadow* elucidates how until the early 1980s, "diets with daily consumption of milk and meat were the privilege of OECD country citizens and a small wealthy class elsewhere" and that animal foods were "an unaffordable luxury" "for most people in Africa and Asia" (Steinfeld et al. 2006, 14). However, the text fails to mention that the high daily consumption of animal protein was unprecedented in those OECD countries, as well, and that next to class and other factors, this consumption was the privilege of white cis-men of a specific religion, and age. What is more, in one sentence, the authors generalize the dietary preferences of the African and Asian population as a whole. Such a declaration and the "convergence of diets" and "nutrition transition" narratives discursively eradicate and amalgamate the culinary and social culture and history of billions of people, which adds to the imperial and colonial character of the modern "dietary convergence." A similar process occurred during colonization: in the Americas, the colonizers labelled all peo-

271 The quote goes: "The livestock sector performs critical development functions through its contribution to nutritious diets, economic growth, and livelihoods. Sector growth thus provides opportunities for development and poverty alleviation." (Global Agenda for Sustainable Livestock 2014a).

272 With the rising affordability of meat, class is nowadays marked by additional factors such as fresh, healthy, organic food (Weis 2013a, 83).

ple “Indians,” in Africa, “Negroes” or “Blacks.” In both cases, the specific cultures, histories, and identities of Aztecs, Mayas, Aymaras, Chibchas, and Ashantis, Yorubas, Zulus, Baconogs, and many more, were amalgamated and erased (Quijano 2000, 551–52). As laid out in part 3.2.3 on modernization theory, modernity has a second, “darker” side: coloniality (Ramnath 2011, 29–30).

In the Livestock Revolution discourse, cultural or religious factors, the heterogeneity of the regions and climates in question, and other elements influencing diet like gender, class, or race are relegated to the sidelines.[273] By the same token, the cultural status of livestock for human society, such as a reflection of social status or as dowry, is not very prominent. All this despite the significant cultural and religious dietary rules and traditions. The Revolution authors write that cultural differences make poultry meat and eggs the most popular livestock goods in the world, that pork is not deemed pure in many religions, and that lactose-intolerance is widespread in East Asia (Delgado et al. 1999, 8). Other documents claim that cultural factors have determined meat consumption and will do so in the future, for example beef consumption in India, or the consumption of pigs in Muslim countries (FAO 2011b, 6), and that differences of religion and taste decide on the animal species and quantity consumed (Steinfeld 2004, 22).[274] But these assertions remain anecdotal compared to the dominant quantitative narrative of the Revolution, explaining it in the economic and demographic terms of economic growth, population increase, and urbanization.

As outlined in the introduction, this thesis should neither romanticize non-Eurosettler food cultures, nor paternalistically decide for billions of people in the Majority World which diet or which way of life they should adopt. Vegetarianism, for instance, is much more common in the Majority World than in the Minority World. Moreover, it is not the aim to deny or morally judge cultural change. The point is to demonstrate how it is the *Livestock Revolution* that denies the cultural difference and complexity of diverse regions in the Majority World by, on the one hand, discursively placing all social development on the meat-centered modernization latter, and, on the other hand, by the structural chokehold of livestock industrialization which is pro-

273 Such a perspective is human ecology, analyzing how environmental factors influence human activities. Cross-national evaluations show that in Asia, with growing gross domestic product, fish consumption is increasing on a much higher scale than meat consumption. In the Minority World, it is the opposite. York and Gossard conclude that in nations with more land per capita and hence more surplus grain, meat consumption is higher, and in countries with more access to water, fish consumption is higher. Furthermore, meat consumption is more widespread in temperate regions than in subarctic/arctic and tropical regions. Yet the authors themselves contend that in a globalized economy, and with the separation of production and consumption, the importance of these factors decreases (York and Gossard 2004).

274 Farrell maintains with regard to the poultry revolution: “Traditionally Indians have been largely vegetarians, partly because of religious belief but also because they did not have the funds to purchase livestock products.” (Farrell 2002, 1). Udo et al. (2011) debate the growing demand for sheep in Indonesia for Muslim feasts and sacrifices.

moted by international institutions, corporations, governments and exporting countries in the Minority World in the need of new markets.

The "convergence" of diets, hence, is thus better defined as the "meatification" of diets. Diets are being "meatified," and this "meatification" is not only a reflection of global injustice—for the reasons laid out before—but also an exacerbation and reproduction of this injustice (Weis 2013a, 9). Once more, the notion of "imperial meat" takes shape. Weis:

> "While the meatification of diets has long been held as a goal and measure of development and a marker of class ascension, it should instead be understood as a vector of global inequality, environmental degradation, and climate injustice." (Weis 2013b, 81–82).

Hornborg sustains that capitalism makes the exploited believe that they should be grateful for their exploitation—in the name of "development" (Hornborg 2009, 244). The same discourse of "offering opportunities" is taking place with the Livestock Revolution. Diverse agricultural models are equally viewed as stages of an "organic, endogenous development," as if structural adjustment programs, foreign direct investment, or the world market did not exist. Industrialization in the Majority World is elucidated as part of the general "growth and modernization of global agri-food systems" (Costales, Gerber, and Steinfeld 2006, 24).

> "As countries industrialise, they follow a pattern in relocating livestock production" (Costales, Gerber, and Steinfeld 2006, 22).
> "As soon as urbanization and economic growth translate rising incomes into 'bulk' demand for animal food products, large scale operators emerge." (Steinfeld et al. 2006, 19).
> Agricultural "system change" is "an endogenous process in response to increased population pressure." (Thornton et al. 2009, 120).
> "In areas where economies are beginning to take off, managing the transition of the livestock sector requires a mix of policy institutional change, technology, and investment." (Dijkman 2009, 4).

Likewise, the Revolution authors refer to a convergence of livestock systems and productivity levels—except for Sub-Saharan Africa:

> "While livestock systems and productivity levels in some developing countries have begun to converge with those in developed countries, some whole regions, such as Sub-Saharan Africa, have fallen behind." (Delgado et al. 1999, 63).

Again, a unidirectional, linear (albeit subtler) model of development is supposed. Yet, economic policies, subsidies for CAFOs, or supermarket penetration are not issues of fate but rather of economic and political decisions. They enable a high consumption of livestock products in the first place through their provision of cheap animal foods. That these commodities are worth eating and buying, on the other hand, is the manifestation of the symbolic power of meatification.

5.7.2 Poverty alleviation

> "Livestock sector growth contributes to poverty reduction and development" (Global Agenda for Sustainable Livestock 2016c).

The second assertion and storyline naturalizing the Livestock Revolution is its contribution to poverty alleviation. "No other sector is more important to the lives and livelihoods of the poor than livestock," according to the Global Agenda (Global Agenda for Sustainable Livestock 2014a). The documents on the Livestock Revolution never stop emphasizing the vital status of livestock for "the most vulnerable," in particular the publications of the International Livestock Research Institute with its focus on poor smallholders.[275] Livestock is portrayed as a "traditional" source of income for "the poor" (Delgado et al. 1999, vii). 1.3 billion people worldwide depend on livestock production, out of those 800 million poor small-scale farmers the Majority World (Thornton, Herrero, and Ericksen 2011, 1). The majority of poor, landless people are women* (Delgado et al. 1999, 40, 42; FAO 2011b, 3; Global Agenda for Sustainable Livestock 2014b, 4); however, gender is almost never used as a lens of analysis, despite the fact that the International Livestock Research Institute writes that "poor women" are the "primary clients of ILRI" and should be "involved as genuine participants in research affecting them" (ILRI 2002, 2).

Livestock provides the poor with cash income, food, manure, and draft power, independently from agricultural seasons and shocks (Blümmel et al. 2013; Dijkman, Gebrewold, and Pearson 2000). The manure is essential "especially when rising petroleum prices make chemical fertilizers unaffordable," the Revolution report claims. Moreover, livestock is a form of insurance "for people who have no other financial markets available to them" (Delgado et al. 1999, 3). Ultimately, livestock as a status symbol also embodies "non-tradable functions" like payment of dowry (Dijkman 2009, 2; Hoffmann 1999; Mathias 2012). Most vitally, via the use of "common-property resources," livestock production is accessible for the landless poor. Consequently, it "offers one of the few rapidly growing markets that poor, rural people can join even if they lack substantial amounts of land, training, and capital" (Delgado et al. 1999, 3, 40). This is why the Livestock Revolution "is a rare opportunity for smallholder farmers to benefit from a rapidly

275 Thornton, Herrero, and Ericksen elaborate how livestock is crucial for the "resilience of vulnerable poor people" (Thornton, Herrero, and Ericksen 2011, 2).

growing market" (Delgado et al. 2000, 10). They can expand their production of "high value livestock products and by-products […], particularly so in arid and semi-arid areas where crop production is not a viable alternative" (FAO 2008, 2). For all these reasons, livestock is depicted as the number-one "pathway out of poverty" (FAO 2008, 1; ILRI 2002). Joining the Revolution appears to be a humanitarian imperative.

From the very beginning, the Livestock Revolution is presented as full of prospects. Nonetheless, the paradoxes are immediate. The ongoing, rapid industrialization of the sector threatens to drive out the poor (AGTR 2011; Delgado et al. 2000, 10). Consequently, the opportunities should only benefit the poor if they were accompanied by "the right policies and technologies" (ILRI 2000a, 3).[276] The foreword of the Revolution Report, authored by the Director General of the International Food Policy Research Institute, the Assistant Director-General, Agriculture Department of the FAO and the Director General of the International Livestock Research Institute, stresses the need for policies to "help small, poor livestock producers become better integrated with commercial livestock marketing and processing." It depends on such policy-action "whether the Livestock Revolution helps or harms the world's poor and malnourished." (Delgado et al. 1999, vii). In a nutshell, if countries adopt policies for the poor, they should "quickly reap the benefits" of the Revolution. However, if they "adopt a *laissez-faire* approach," they risk that the poor will be "shut out of one of the few expanding markets available to them." (ILRI 2000a, 10 [original emphasis]). The International Livestock Research Institute in particular concentrates on "ensuring that the Livestock Revolution serves the poor." (ILRI 2000b, viii).

The message is straightforward, and does not leave room for interpretation. The Livestock Revolution, this unprecedented, dramatic shift in global agriculture, will be either a blessing or a curse. The International Livestock Research Institute names poor livestock keepers as the "major equity issue" of the Livestock Revolution (ILRI 2000a, v). Even the World Bank underscores the Revolution's detrimental effects on "social equity" (World Bank 2005, ix). Notably, the necessary counterpart of monetary poverty, wealth (Rist 2008, 229), is neither scandalized nor deemed a major equity issue. Being "vulnerable" or "poor" seems to be a natural, deficient state that lacks structural reasons. Further, "the poor" are depicted as one homogenous category.[277]

276 Steinfeld: "There is a danger that livestock production and processing will become dominated by integrate large-scale commercial operations, displacing small-scale livestock farmers and thus exacerbating rural poverty and malnutrition. […] On the other hand, correctly managed, a dynamic livestock sector could prove catalytic in stimulating rural economies." (Steinfeld 2004, 40).

277 The uniform terminology of "the poor" is maintained to reflect the discourse.

Notwithstanding this, the authors are aware of the many large pitfalls of the Revolution. At times, their accounts are a confirmation of the status quo, and at other times, they are highly critical of the manifold challenges for "the poor." According to the FAO, the key problems encountered by the poor are lack of access to land and water and the risks of animal diseases, drought, and theft (FAO 2008, 5). They poor face several barriers to market integration: lack of capital for the necessary investments, inappropriate or insufficient access to land, urban markets, technology, and information about markets (Dijkman 2009, 4; Lapar, Holloway, and Ehui 2003; Rivera-Ferre 2009, 99; Steinfeld et al. 2006, 18). Market access is described as even more difficult for women* (ILRI 2002, 7).

As the Revolution authors specify, the poor cannot benefit from economies of scale and low transaction costs like large producers. The latter have a higher negotiating power and higher level of market information, they enjoy tax holidays, they profit from government services and subsidies, and they have access to better infrastructure, which is crucial for dealing with such perishable goods (Costales, Gerber, and Steinfeld 2006, 19–20; Delgado et al. 1999, 42; ILRI 2000a, 17).

What is more, changing economic conditions are not favorable for smallholders (van der Zijpp, Wilke, and Carsan 2010, 142). The Livestock Revolution is "underpinned by structural changes along the whole animal food supply chain," according to Costales, Gerber, and Steinfeld. Characteristics are large retailers, industrialization, and vertical integration—the industrial meat regime. This development is not favorable for small-scale producers. Costales, Gerber, and Steinfeld point out that "sustaining the revolution may not be compatible with sustaining small scale livestock production" (Costales, Gerber, and Steinfeld 2006, 15). Small poultry and egg producers in particular will have a hard time competing against the industrial sector (Delgado, Narrod, and Tiongco 2008, 122).

At this point, it is important to bear in mind that the same structural changes in the sector have already occurred in the Minority World. "[Y]ou have to grow in order to survive" has been and still is the imperative for many farmers in Europe and Turtle Island. As outlined in part 2.1.3.2 on corporate consolidation, thousands of small-scale farmers have been pushed out of business, from the United States to Denmark and Romania. Many of the remaining family farms are heavily indebted (Mathias 2012, 1–2). Notably, the documents on the Livestock Revolution are silent about these negative consequences and the precarious situation of farmers in the Minority World. *Livestock's Long Shadow* soberly contends:

> "there is a need to accept that the intensification and perhaps industrialization of livestock production is the inevitable long-term outcome of the structural change process that is ongoing for most of the sector." (Steinfeld et al. 2006, 283).

A decade after the declaration of the Revolution, case studies illustrate its impact in the Majority World. Millar and Photakoun determine that market dynamics are leading to increased social inequality and ruling out small-scale producers in the Lao People's Democratic Republic (Millar and Photakoun 2008, 91). In a Brazilian case study, Lundström (2011) concludes that the Revolution marginalizes small-scale producers: it forces them to upscale their production and exposes them to financial risk. Rae and Zhang (2009) suggest that the Revolution can deepen income inequality in China. Upton (2000) examines the implications for smallholder agriculture in Kenya. He maintains that in the Majority World, the number of people working in agriculture is still rising, yet land resources are becoming increasingly scarce. Intensification is seen as the only option for sustaining farmers (Upton 2000, 4). Nevertheless, intensification benefits those who already own land, nonhuman animals, and feed, and who, in addition, have access to technology and the market (Millar and Photakoun 2008, 90-91, 99-100; Udo et al. 2011).

More disadvantageous tendencies for "the poor" include trade liberalization, volatile prices on the world market, and booming urban markets favoring peri-urban intensified production. The shift from pastoral ruminant to industrial monogastric production entails higher expenses for feed. Additionally, grain prices continue to spike (see subdivision 5.7.3 on food security), and grasslands are increasingly deteriorated (MacLachlan 2015, 32–33; Millar and Photakoun 2008, 92, 100). The increasing need for imported vaccines, feed, or antibiotics puts pressure on small-scale farmers (FAO 2005, 5). Food safety regulations, a precondition to enter the international livestock market and trade, can be hard for smallholders to meet (ILRI 2000a; Steinfeld 2004, 23, 35; compare Hall, Ehui, and Delgado 2004 on the impact of WTO sanitary and phytosanitary standards on smallholders). The Revolution is characterized by the growing influence of supermarkets, and compliance with their quantity and quality (uniformity) demands are another hurdle for small producers (Lundström 2011). Mathias (2012) and Delgado, Narrod, and Tiongco (2008, 122) observe how livestock turns from an asset into a liability: smallholders take out loans to afford the necessary investments and accumulate substantial debt. If they are not able to meet the requirements, transnationals "will find little incentive" to choose them as suppliers and will go for bigger producers (Costales, Gerber, and Steinfeld 2006, 19).

In essence, the FAO demands that "livestock keepers" must become "livestock producers," they have to produce "beyond survival requirements to benefit from expanding market opportunities" (FAO 2008, 5). Small-scale producers who will not intensify and partake in the concentration of

production “may be squeezed out of the sector” (FAO 2011b, 1; 2005, 2)—or, as Costales, Gerber, and Steinfeld more subtly write, they are “taken out of the market chain loop” (2006, 19). This involves that “those who need the activity most could be driven out” (Delgado et al. 1999, 42).

These assertions echo the apprehensions that the Revolution could be either blessing or spell for the poor. While the degree of concern is different in each paper, the Global Agenda downplays concerns about the need for “equitable development,” only sporadically addressing poverty (“the poor” are completely absent) (Global Agenda of Action 2013, 2). Most publications, nonetheless, place stress on deliberate pro-poor policies. The original Revolution report identifies four policy necessities that refer to the changing economic conditions in the sector:

> “(1) removing policy distortions that artificially magnify economies of scale in livestock production; (2) building participatory institutions of collective action for small-scale farmers that allow them to be vertically integrated with livestock processors and input suppliers; (3) creating the environment in which farmers will increase investment in ways to improve productivity in the livestock sector; and (4) promoting effective regulatory institutions to deal with the threat of environmental and health crises stemming from livestock.” (Delgado et al. 1999, 4).

As a consequence of the Revolution document, the FAO launched the “Pro-Poor Livestock Policy Initiative” in 2001 (MacLachlan 2015, 31).[278] The International Livestock Research Institute issued several reports and strategies on “how to make the livestock revolution work for the poor” (ILRI 2000a; 2000b; 2000c; 2005); the International Food Policy Research Institute contributed, among others, the publication Delgado, Narrod, and Tiongco 2008. In their “Livestock Policy Brief” 2005, the FAO demands policies for the elimination of market distortions such as subsidies, the support of participatory producer cooperatives, the establishment of land tenure rights, and regulation of access to communal lands, micro-credits and veterinary services (FAO 2005). However, as if the FAO was afraid of painting a picture that was too friendly to smallholders, it reassures the reader in its 2008 “Livestock Policy Brief” on “Livestock Policy and Poverty Reduction:”

> “The goal of the proposed policies is not to promote a smallholder-dominated livestock sector but to establish a level playing field which allows smallholders to make choices with respect to expanding their holdings, linking-up with other producers or withdrawing from the livestock sector altogether.” (FAO 2008, 4–5).

278 Its homepage http://www.fao.org/ag/againfo/programmes/en/pplpi/home.html does not exist anymore (19 January 2017).

Similarly, FAO author Dijkman calms:

> "The objective of pro-poor livestock sector development interventions […] should not, however, be to punish largescale production nor to maintain smallholder production systems at any cost." (Dijkman 2009, 4).

It perhaps does not come as a surprise, then, that the FAO evaluation of existing pro-poor policies in Africa, Asia, and Latin America in the same Policy Brief of 2008 is sobering. On the one hand, existing pro-poor policies in Africa, Asia, and Latin America do not focus on livestock, and if they do, they prioritize productivity increase rather than poverty alleviation. Livestock policies, on the other hand, neglect the needs of small-scale producers, and they will probably continue to do so in the future (FAO 2008, 6–7). Heffernan (2004) notes that "rhetoric of 'poverty-focused' projects and programs often dominates," yet "very little work" has been done to understand more completely the relationships between livestock and poverty and the Revolution's macro-economic effects on poor livestock keepers. Steinfeld presents a similarly critical account:

> "Development interventions in the livestock sector have, generally, not been very successful. Undoubtedly, inappropriate technologies and the failure to deliver services to poor farmers have contributed greatly to the lack of success of many livestock development projects. However, even in cases where the technologies were appropriately targeted and the focus was distinctly pro-poor, technical projects have in many cases failed to deliver any significant sustainable improvements in the livelihoods of the poor. Analyses of these issues clearly indicate that an enabling institutional and political environment is indispensable in adopting a pro-poor focus, enhancing the sustainability of pro-poor interventions, and ensuring that agricultural intensification strategies have impact at the desired social levels." (Steinfeld 2004, 33–34).

The requisite institutional and political environment is the crux of the matter. In 1999, the Revolution authors deplored how public health services are weakened in parts of the Majority World since "government services are being curtailed" (Delgado et al. 1999, 51). The International Livestock Research Institute specifies: policies favoring human and environmental health, necessary for the Livestock Revolution, might be difficult for "cash-strapped governments in developing countries […], especially at a time when many of them are being urged to cut public expenditure." (ILRI 2000a, 22). In 2005, the FAO observe that the funding of public agricultural research has declined, but the funding of private agricultural research increases, which exclusively benefits the growing industrial sector (compare equally ILRI 2000c on stakeholder roles

and expectations from international livestock research). Likewise, veterinary services are increasingly privatized (FAO 2005, 6–7).

On top of those political and economic variables, climate change continues to aggravate the situation of poor producers (Rege et al. 2011). 105 million tons of total losses in future cereal production are estimated for 2080 (Keyzer et al. 2005, 198). Nardone et al. (2010) anticipate a 25 percent loss of animal production in the Majority World due to climate change. Heat waves, severe droughts and water scarcity, desertification, soil infertility, and higher solar radiation on animals will especially affect pasture-based production in Africa and some parts of Asia. As the researchers specify, industrialized systems will be better prepared for these changing conditions because they can adjust the temperature, humidity, and feed and medication input in the controlled environment of CAFOs. In addition, *Tackling Climate Change* expresses fears that adopting existing greenhouse gas mitigation strategies—turning animal exploitation sustainable—could constitute a socio-economic risk for subsistence farmers.[279]

For FAO analyst Dijkman, it is illusory to think that subsistence farmers could "tap the potential" of the Livestock Revolution and enter the global market; he calls it outright "wishful thinking." As noted above, such market entry entails risk, competition, the compliance with international standards, and so on. Small-scale producers neither have the assets nor capacity to deal with the constant change in the fast-paced global market (Dijkman 2009, 2). Structures inhibit "the poor" in partaking in the Revolution. Dijkman compares the Livestock Sector with a broken ladder, the rungs at the bottom symbolizing the informal sector of small-scale farmers:

> "it appears that the 'livestock ladder'—the process by which smallscale traditional livestock keepers could gradually intensify and scale up their production, and, in doing so, use livestock as 'pathways out of poverty'—is largely a myth. The 'ladder' seems to have rungs at the bottom and top only, with a yawning, generally insurmountable void between the two." (Dijkman 2009, 2).[280]

279 As detailed above, livestock traditionally provides smallholders with a variety of ancillary services, including draught power, the provision of manure, financial, social, or insurance functions. The publication *Tackling Climate Change* perceives the danger that efficiency improvements and a lower herd size will diminish those non-food production functions, and warn that "a single-minded commodity-based focus on production efficiency can come at the expense of some ancillary services of livestock that are important for poor rural households, including their role as a store of wealth." (Gerber et al. 2013, 99). "Unless they are able to be cost-effectively substituted with mechanization, use of artificial fertilizers, and banking and insurance systems, these lost services would be detrimental to farm household livelihoods" (Gerber et al. 2013, 88).

280 Industrialization does not necessarily impinge on that sector, and that is why Dijkman deems it equally fictitious that industrialization pushes small-scale farmers out of business (depicted with the 'livestock slide'). Still, the yawning, "widening gulf" between the industrial and the informal livestock sector in countries where the Livestock Revolution is supposed to take place remains a matter of concern (Dijkman 2009, 2–3).

In point of fact, the increasing demand for animal products has, until now, not benefitted small-scale producers but "a relatively small number of large producers" instead (Steinfeld 2004, 32). And this is meant to last: the Livestock Revolution will almost uniquely be driven by large-scale producers (Dijkman 2009, 4; Steinfeld 2004, 23). And, according to *Livestock's Long Shadow*, this intensification "is only achieved at the cost of pushing numerous small- and middle-scale producers […] out of business," despite the overall growth of the sector (Steinfeld et al. 2006, 279).

Nonetheless, declarations as straightforward as the latter, or the ones quoted above, are rare. In general, the authors are cautious in making clear statements about the future of pastoral and mixed systems—which signifies, the future of the *majority* of the sector—and use a lot of hedging rhetoric.[281] Nonetheless, despite the authors' reluctance to realistically assess the extremely precarious position of small-scale farmers, they predict their needed "transition" to another sector:

> "For those small-holders that are unable to compete, policies need to be designed that facilitate their transition from the livestock sector towards other livelihood options." (FAO 2011b, 29).
>
> As "further job shrinkage in the agro-food sector" is likely, "appropriate exit strategies for those smallholders who decide to leave the sub-sector" are needed (FAO 2008, 5).
>
> "[E]xit strategies should be designed for those who are unable to cope." (Costales, Gerber, and Steinfeld 2006, 25).

Fifteen years after the announcement of the Revolution and the repeated need for pro-poor policies, the Global Agenda austerely determines that the poor might not fit in the model of development. Yet, the "viable growth in value chains" should allow the poor to "find secure livelihoods and participate in growing markets or take up other opportunities outside the sector" (Global Agenda for Sustainable Livestock 2014a).[282]

In these times and conditions, the benefits of animal exploitation for the "rural poor" are more than doubtful. Instead of evening out social inequalities, the Livestock Revolution appears to exacerbate them, as the Green Revolution did in India and around the world (Holt Giménez and Shattuck 2011, 110; Khan and Bidabadi 2004, 99). For Dijkman, in the course of the Livestock

281 In an interesting exploration, the World Bank presents mixed evidence: the emergence of large-scale producers in some countries crowded out small-scale producers; in others, a parallel system evolved. Vertical integration can provide employment opportunities for the poor, nonetheless, it can also cost farmers' independence and reduce their margins. Likewise, cooperatives show a mixed record worldwide (World Bank 2005, 13–14).

282 Compare a similar statement by the FAO in 2011: "Even where production is in the hands of larger-scale commercial livestock owners [...], there will be employment opportunities generated along the value chain; both up-stream and down-stream of the producer." (FAO 2011b, 29).

Revolution, "livestock is an expression of poverty, rather than a pathway out of poverty" (Dijkman 2009, 2). Yet, Pica-Ciamarra et al. (2015) find that factors like farming systems, species, class and the use of livestock determines if livestock contributes to poverty reduction: there is no universal wisdom about it.

What is quite startling in the Livestock Revolution discourse is that the heavily discussed "poor livestock keepers" whose future is threatened by the Livestock Revolution do constitute the *majority* of the sector (FAO 2008, 4). The *majority of food* consumed in the Majority World (both animal and plant-based) is equally produced by small-scale, semi-subsistence farmers (Steinfeld 2004, 32). In Senegal, Sudan, and Niger, outright 80 percent of agricultural output is supplied by pastoralists (Mathias 2012, 8). In other words, the Livestock Revolution bypasses the bulk of its current producers and consumers in the Majority World and is completely geared towards the global agri-food players who rule the sector and who, in turn, produce for consumers in the Minority World. This circumvention demonstrates the discursive instrumentalization of "the poor" in efforts to legitimize the Livestock Revolution.[283] To a considerable degree, the storyline of the sector's commitment to "food security and poverty alleviation" and the call for pro-poor policies look like mere lip service in face of the actual socio-economic, political, and environmental situation. Fritz of the German Centre for Research and Documentation Chile-Latin America sums it up:

> "The livestock development strategy promoted by international organisations like FAO, IFPRI and ILRI actually resembles more a declaration of surrender to the forces of the industrial livestock complex than a poverty-sensitive approach where the most vulnerable smallholders take centre stage." (Fritz 2014, 14).

Rather than philanthropically feeding and "modernizing the poor" with products from animal exploitation (Twine 2012, 14), international lobbies and corporations are trying to capture new markets in view of stagnating turnovers in the Minority World (Sanbonmatsu 2011b, 23). In this sense, the discourse of "poverty alleviation" in reality constitutes a process of economic and cultural imperialism.

5.7.3 Food security

> "The livestock sector is vital to global food security and health" (Global Agenda for Sustainable Livestock 2016c).

283 See also Rivera-Ferre (2009, 102). For FAO analyst Dijkman, this "smallholder romanticism" needs "significant revision." Instead, he suggests to explore "the type of capacity that is needed to allow producers to innovate" (Dijkman 2009, 3–4).

The third argument for the naturalization of the Livestock Revolution is its importance for food security. In every single document analyzed for the present study, the storyline that the livestock sector is "vital to global nutrition and food security" appears (Global Agenda for Sustainable Livestock 2014a).[284] The Global Agenda calculates that the complex provides 26 percent of global protein consumption and 13 percent of total calories (Global Agenda for Sustainable Livestock 2014b, 2). As problematized in part 2.3.3 on land-system change, this is not a particularly strong performance, given the sector's occupation of 80 percent of arable land and its use of 35 percent of the global grain harvest for fodder. Still, the discourse accentuates the nutritional benefits of livestock products especially for "vulnerable communities," "the poor," children, and to mankind in general (ILRI 2000a). Animal products are defined as "higher value and quality foods" (Steinfeld 2004, 21, see also AGTR 2011). The farcicality of this argument, however, is that those "vulnerable communities" in rural, pastoral areas will not be the ones benefitting from more animal protein. The Livestock Revolution is a phenomenon of "urban consumers in emerging economies," as noted by Gerber et al. (2013, 83).[285]

And not only will those "vulnerable communities" be deprived of these so-called quality foods—they will additionally have to compete with the sector for their daily bread—or their tortilla, injera, pita, or chapati. As elucidated in the subdivision "Feeding capital" (2.1.4.1), the Revolution authors calculated the world cereal use for feed for the two periods 1992/1994 and 2020 and projected it to more than double in the Majority World—from 194 to 409 million tons. In the same period of time, cereal use in the Minority World was projected to grow by 17 percent. Total use of cereals as feed in the world was forecasted to expand from 636 million tons in 1992/1994 to 928 million tons in 2020 (Delgado et al. 2000, 7, quoted in FAO 2005, 3). How is the use of 928 million tons of cereals for feed by 2020 compatible with food security? When the Revolution report was written in 1999, the authors proceeded on the assumption that the "era of cheap food" would go on, and they made their calculations accordingly. "Real cereal prices, however, are not likely to rise very much by 2020." The Revolution authors justified their projection with the world's "considerable reserve capacity for additional cereal production" (Del-

284 Although the term "food sovereignty" already existed in 1999, food security is the term of preference in the documents examined here.

285 Moreover, the nutritional benefits of animal protein might be levelled out by detrimental health effects. The Livestock Revolution is said to both benefit and impinge on public health (Steinfeld 2004, 19, 23). "As these events unfold, many people's diets will change, some for the better, but others for the worse, especially if food contamination is not controlled." (Delgado et al. 2000, 2). Contaminated products of animal origin are a major source of foodborne diseases; moreover, international trade and industrialized production aggravate the risk of zoonosis (Delgado et al. 1999, 49; FAO 2005, 3). On preventing the spread of animal diseases while still benefitting the poor, from a Livestock Revolution perspective, refer to Hall, Ehui, and Christopher Delgado (2004).

gado et al. 1999, 36).[286] They believed that agricultural production could be expanded and markets would adjust (Fritz 2014, 7–8). They argue:

> "Demand increases for meat and milk have largely been met through expansion of feed production or imports at world prices that are declining in real terms. Historically, the livestock sector has helped stabilize world cereal supply. Evidence from cereal price shocks in the 1970s and 1980s suggests that reductions in cereal supply were largely absorbed by reductions in feed for livestock." (Delgado et al. 1999, 61).

For the Revolution authors, their findings suggest "that the Livestock Revolution is intimately wrapped up with nutritional and food security" (Delgado et al. 1999, 36). Still, in the section on nutrition, food security, and poverty alleviation in the Revolution report, the authors reflect on the social justice aspect of turning cheap food into expensive meat:

> "It seems probable, for example, that massively larger amounts of cereals will be used as feed to produce items consumed primarily by better-off urban people in countries where outright lack of food is still common." (Delgado et al. 1999, 37).

> "Others worry that increased use of feed to produce animal products for the relatively rich puts upward pressure on prices of cereals, the staple food of the world's poor. Feeding cereals and soybeans to animals typically creates fewer calories and less protein than animals absorb." (Delgado et al. 2000, 9).[287]

However, critical deliberations on the threats of feed-grains to food security are designated as "highly emotional and often imperfectly grounded in facts" (Delgado et al. 1999, 37):

> "However, the idea that reduced demand for feed would overcome the complex income, infrastructure, and food distribution problems that result in calorie malnutrition is an unrealistic oversimplification of the problem." (Delgado et al. 2000, 9).

286 The report lists several reasons for the assumed "high supply responsiveness of cereals." First, "the large grain-exporting countries, such as Australia, Canada, and the United States, have the ability to bring large amounts of land typically not sown to grain into cereal production as prices rise." Second, exporting countries can sustain their production by increasing fertilizer use. Third, "in a system of global markets, where actors all over the world respond to changing price incentives, individual shocks are smoothed out over time through myriad adjustments throughout the system. In other words, world supply will be more price-responsive than individual country supply." And fourth, "in areas containing a significant share of the world's poor, the rise in the consumption of calories from animal products is matched by a decrease in calories from starchy staples. […] Rice and wheat are the grains typically consumed in China. These grains have significantly lower average yields per hectare than maize, a feed grain increasingly cultivated by Chinese farmers. Thus, substitution of meat and milk for grain in the diet liberates some grain from direct consumption as food, and the consequent increase in aggregate grain supply is amplified by the relatively higher yields of feed grains per hectare." (Delgado et al. 1999, 36).

287 Note the hedging terminology of "relatively rich." The poor are not described as "relatively poor." *Relative* wealth relativizes inequality.

Correspondingly, the Revolution document's section on food security concludes on an optimistic note:

> "The Livestock Revolution's effect on the food security of poor people, through cereal prices, is likely to be far less important than its effect on the income of the poor." (Delgado et al. 1999, 39).

The 2001 update confirms the 1999 findings (Delgado, Rosegrant, and Meijer 2001, 18). Equally, the International Livestock Research Institute contends that it is a "myth" that feed will compete with human food, and it justifies this assertion with the low expectations for any grain price increase (ILRI 2000a, 11; Vercoe, Fitzhugh, and Kaufmann 2000, 411). Still in 2006, *Livestock's Long Shadow* also observed a "long-term decline of grain prices" since the 1950s and believed this trend would continue (Steinfeld et al. 2006, 12). And in the same, by now familiar contradictory manner, the Global Agenda declares:

> "The Agenda partnership promotes livestock production based mainly on materials not competing with direct use as human food." (Global Agenda for Sustainable Livestock 2014a).

A critical appraisal of this food security assessment raises several questions. First, the difference between cereal production for feed and for food should be emphasized. The above paragraphs have discursively shown that the world had "considerable reserve capacity for additional cereal production" and that production could additionally be boosted to expand the feed base sustaining animal production. The relative ease with which billions of farmed animals can apparently be fed is notable. Given that confidence in global agricultural production, one might ask why it would not be similarly simple to produce the same grains for the millions of people suffering from undernutrition. Nevertheless, here again, capital is at the heart of the matter. In the view of the authors, predominantly agricultural or livestock economists, hunger does not constitute a demand, because the hungry lack the income to manifest the demand. In capitalism, production is geared towards profit, and not needs. Costales and Steinfeld illustrate:

> "The sometimes popular view, that the world hunger problem could be resolved by simply curtailing demand for meat and other livestock products, and thereby releasing grain used as feed for human consumption, is flawed. In the absence of demand for feed grains, less would be produced, and the hungry would still go hungry. This underlines the notion that world hunger is a demand (income) problem rather than a supply problem." (Costales, Gerber, and Steinfeld 2006, 25).

Nonetheless, the agricultural economists observe that the increasing use of grains for feed disadvantages the poor:

> "While it is probably true that livestock do not detract food from those who currently go hungry, it raises overall demand and prices for crops and agricultural inputs." (Steinfeld et al. 2006, 270).

> "[I]t is clear that the growing livestock sector demand for feed grains and other feed ingredients raises the price of these and other similar commodities to higher levels than would otherwise be the case. This makes grains and other staples less accessible to the poor who have to buy them." (Costales, Gerber, and Steinfeld 2006, 25).

Thornton indicates that in the future there will be "considerable competition between food and feed production" (Thornton 2010, 2864). The Global Agenda maintains:

> "There are clearly areas of competition between direct food and feed uses for many crops, and livestock also compete for land and water resources locally, and through trade, globally." (Global Agenda for Sustainable Livestock 2014b, 2).

Second, a perhaps even more substantial observation is that the International Food Policy Research Institute, the Food and Agriculture Organization, and the International Livestock Research Institute were wrong in their predictions about the cereal market. They did not foresee the price hikes of the coming decade (Sumberg and Thompson 2013, 12): cereal and food prices in fact spiked in 2008 and similarly again in 2011. In the three years before 2008, global food prices rose by 83 percent, and world hunger peaked, as well, unleashing a number of food riots in different parts of the world—at the same time, global harvests soared, and the profits of the world's foremost transnational agribusinesses have also rocketed (Holt Giménez and Shattuck 2011, 111). Food prices have diminished since, but remain relatively high, with increased price volatility (Dijkman 2009, 3; Fritz 2014, 7–8). Malnutrition keeps growing (Rivera-Ferre 2009). With rising cereal, and thus feed, prices, the cost of animal foods also increases (Rivera-Ferre 2009, 96). Papers published after the grain price hikes are much less optimistic about the benefits of the Livestock Revolution for the poor and for food security (Sumberg and Thompson 2013, 14). For instance, in their Ethiopian case-study, Ali and Neka speak of a "grim situation" that the livestock sector created with its demand for feed and water (Ali and Neka 2012, 208).

Not only grain prices but feed demand as well has supposedly been underestimated. With global population growing by 40 percent by 2050 and a higher average food energy intake, agricultural production must increase by 70 percent. This translates into an additional billion tons of cereals

compared with production in 2005/2007 (FAO 2011b, 5). Yet Keyzer et al. project an additional global demand of almost two billion tons of cereals already by 2030 (Keyzer et al. 2005, 198). In 2016-2017, the use of cereals for feed was 35 percent of global cereal utilization, amounting to 2,564 million tons (FAO 2016f). Herrero et al. estimate that almost 50 percent of the grain produced between 2000 and 2050 will go to feedthroughs (Herrero et al. 2009, 112).

A third reflection covers the approach to food security in the first place. As echoed in some of the Revolution documents, and as shown in detail in chapter two on the animal-industrial complex, animal production is an inherently inefficient way to create food.[288] The production of plant-based calories is four to twenty times more efficient than the production of calories from animal products (Bajželj et al. 2015; van der Zijpp, Wilke, and Carsan 2010, 135). Yet again, in capitalism, efficiency is not defined in terms of satisfying needs but rather in monetary terms. The inefficient cycling of nutrients through animal bodies in order to sell meat, or the "destruction of large volumes of useable nutrition in grains and oilseeds," as Weis puts it, makes sense in capitalism (Weis 2013b, 76). Any discussion of food security should bear in mind that the animal-industrial complex does not aim to "*create food*, but *to make money*" (Gunderson 2013, 260–61 [original emphasis]). Weis elaborates:

> "the great surpluses of cheap food from the industrial grain-oilseed-livestock complex involve an illusion of efficiency, which is defined in terms of high yields and high productivity per farmer." (Weis 2013b, 80).

The illusion of efficiency belongs to the productivist approach to food security, a unidimensional line fixated on the continuation of the Livestock Revolution, and the ongoing meatification of diets:

> "Meatification is thus a key part of the serious misrepresentation that occurs when champions of high-input agriculture portray hunger and future food security as matters of enhanced yield, and by extension matters of more input-intensive approaches and/or continuing genetic modification of seeds and animals. Rather than ratcheting up insufficient yields and production, a much more compelling priority is to urgently ratchet down meat consumption and confront the social and ecological disaster that is industrial livestock production." (Weis 2013b, 80).

288 Even *Livestock's Long Shadow* acknowledges: "Livestock compete for crops but provide a buffer against grain shortages. In simple numeric terms, livestock actually detract more from total food supply than they provide. Livestock now consume more human edible protein than they produce. In fact, livestock consume 77 million tonnes of protein contained in feedstuff that could potentially be used for human nutrition, whereas only 58 million tonnes of protein are contained in food products that livestock supply. In terms of dietary energy, the relative loss is much higher. This is a result of the recent trend towards more concentrate-based diets for pigs and poultry, with nutritional requirements more similar to humans than ruminants." (Steinfeld et al. 2006, 270).

5.7.4 Environmental benefit

> "The livestock sector is crucial to society achieving its environmental, social and economic and health objectives"
> "The livestock sector can contribute significantly toward climate change mitigation" (Global Agenda for Sustainable Livestock 2016c).

The fourth line of argument and storyline naturalizing and legitimating the Livestock's Revolution is its positive relationship with the environment. The following paragraphs trace this ecological discourse and then classify the Revolution's environmental impact according to the planetary boundaries of climate change, biogeochemical flows, freshwater use, land-system change, and change in biosphere integrity.

A peculiar feature in the discourse is the periodical downplaying of the sector's contribution to climate change. For instance, the International Livestock Research Institute details that "it is worth remembering that animal themselves are neutral in their effect on the environment," and that what matters are the management of livestock and regulation towards "sustainable production" (ILRI 2000a, 10). What is more, livestock systems, "if managed properly, play their part in […] counteracting environmental degradation" (ILRI 2002, i). In addition, the emissions of the complex are justified with its social contribution. Thornton, Herrero, and Ericksen contend that

> "[g]iven that almost all human activity is associated with GHG emissions, those from livestock in these systems are relatively modest when compared to the contribution that livestock make to the livelihoods of this huge number of people." (Thornton, Herrero, and Ericksen 2011, 2).

The *Tackling Climate Change* report adversely (and somewhat paradoxically) claims:

> "The global livestock sector contributes a significant share to anthropogenic GHG emissions, but it can also deliver a significant share of the necessary mitigation effort." (Gerber et al. 2013, xii).

The Global Agenda even lauds the livestock sector for being "instrumental in landscape management and enhanc[ing] biodiversity in numerous settings" (Global Agenda for Sustainable Livestock 2014b, 7), and recognizes "the potential contribution of livestock to the sustainable use of terrestrial ecosystems, […] and to improve biodiversity" (Global Agenda for Sustainable Livestock 2016e). The Global Agenda does not, however, provide any reference for these allegations. Other papers indicate local environmental benefits as well, such as enhancing biodiversity, carbon sequestration, and landscape maintenance, but only in reference to pastoral and agro-forestry systems (Herrero and Thornton 2013, 20879; Steinfeld 2004, 34). Herrero et al.

(2009, 118), on the other hand, portray industrial agriculture as decreasing the sector's overall impact on biodiversity by more efficient production. Barrett adds that the "environmental benefits of industrial systems may seem elusive, but they do exist." (Barrett 2001, 317).

The contradictions on the environmental repercussions of the animal-industrial complex, and of the Revolution in particular, are probably the most confounding aspect of the whole discourse. Chapter 2.3 has advanced a systematic examination of the sector's contribution to the ecological crisis, and to the crossing of planetary boundaries. In view of those variables, to claim that the livestock sector is crucial to society in "achieving its environmental objectives," according to the Global Agenda for Sustainable Livestock in 2016, is quite astounding—and can be read as a distraction from the massive detrimental impact of the animal-industrial complex.

At the same time, the discourse features rather pessimistic perspectives on the ecology of the Revolution. The Revolution report prognoses "unprecedented stress on the resources used in livestock production" as the sector changes from using "surplus and waste resources" to seeking "new resources" (Delgado et al. 1999, 2) and dedicates a whole paragraph to the "Risks of the Livestock Revolution," including environmental threats like land degradation, deforestation, air pollution, and waste problems (Delgado et al. 2000, 9). According to the Livestock Policy Brief "Responding to the 'Livestock Revolution,'" those repercussions are predominantly generated by rapidly spreading industrial livestock systems (FAO 2005, 6). Costales, Gerber, and Steinfeld fear "externalities in the form of environmental damages" if ongoing industrialization is "poorly managed" (Costales, Gerber, and Steinfeld 2006, 15), that is, if exploitation is not transformed into sustainable exploitation. *Livestock's Long Shadow* maintains that the complex "is a major stressor on many ecosystems and on the planet as a whole" (Steinfeld et al. 2006, 267), and it worries:

> "In the absence of major corrective measures, the environmental impact of livestock production will worsen dramatically. Viewed very simply, if production doubles, without any reduction in environmental measures per unit of production, then environmental damage will double." (Steinfeld et al. 2006, 275).

In 2011, the FAO deems it "certain" that the Livestock Revolution will pointedly threaten food security, fresh water and forest resources, that it will impact climate regulation and air quality, and that it will champion infectious diseases (FAO 2011b, 31). On a different level, Hegarty (2013) and Leng (2005) question a "business-as-usual" continuation Livestock Revolution because of its dependence on declining oil reserves. The *Tackling Climate Change* document equally expresses its apprehension about future livestock production:

> "With demand for livestock products projected to grow by 70 percent by 2050, concerns about the unbalanced nature of this growth and its attendant environmental and socio-economic consequences are increasing. To date, most of the increase in demand has been met by rapidly growing, modern forms of production while hundreds of millions of pastoralists and smallholders, who depend on livestock for survival and income, have little access to emerging opportunities for growth. In addition, there is increasing concern about the impact of production growth on natural resources of which the sector is a large user; it is, for example, the world's largest user of agricultural land." (Gerber et al. 2013, 83).

This comment reciprocates the ever-increasing amount of scholarly evidence on the ecology of the Livestock Revolution. What do the scrutinized documents say about the forecasted environmental repercussions? How will the Revolution affect planetary boundaries? The following paragraphs are not a complete but rather a basic enumeration of the future drains on nature. Most publications maintain their silence about the concrete environmental impact of the Livestock Revolution. Yet this minimalist account mirrors the weight ecology is attributed in the Livestock Revolution discourse. Perhaps environmental sustainability is just not a priority. Indeed, *Livestock's Long Shadow* asks: "what relative value should we assign to the environment, compared to other objectives such as the provision of livelihoods or the cheap supply of animal products?" (Steinfeld et al. 2006, 267). Similarly, Thornton speaks of "[t]rade-offs between food security, poverty, equity, environmental sustainability and economic development" that will "inevitably" occur in future livestock development (Thornton 2010, 2856–2957). One wonders how such a trade-off should look like given the biosphere is the basis of all life and human endeavors.

5.7.4.1 Climate change and biogeochemical flows

As outlined in part 2.3.1, one goal of climate change mitigation is to keep emissions below two degrees Celsius by the end of the twenty-first century. Hedenus, Wirsenius, and Johansson (2014) advance a maximum of 13 gigatons carbon dioxide equivalents of total annual emissions of *all* sectors for the year 2070 if this target is to be met with a chance of above 50 percent. Yet, they similarly calculate that the agricultural sector alone—without including any other global sector, like energy or transport—will total approximately emissions of 13 gigatons carbon dioxide equivalents in 2070 if the Livestock Revolution is to happen without rapid increases in productivity and "dedicated technical mitigation measures." Animal products account for 80 percent of those 13 gigatons. The authors warn that "food-related emissions, if they remain unabated, are on track to take up most, if not all, of the long-term annual emission space allowable under the 2 °C target" (Hedenus, Wirsenius, and Johansson 2014, 85–86).[289]

289 It is relevant to note that the authors' reference value is 7.1 gigatons carbon dioxide equivalents per annum in 2000 (Hedenus, Wirsenius, and Johansson 2014, 79), which is lower than the FAO calculation applied in this thesis (*Tackling Climate Change* determines emissions of 7.1 gigatons carbon dioxide equivalents per annum just for the

The prognosis of Bajželj et al. (2014) is even more serious. They estimate that the projected Revolution (Alexandratos and Bruinsma 2012) alone—again, just one part of the agricultural sector—would engender a global warming of two degrees Celsius even earlier, by 2050 (and not 2100, as the Intergovernmental Panel on Climate Change's scenario predicts) (Bajželj et al. 2014). Pelletier and Tyedmers determine that greenhouse gas emissions will increase by 39 percent above levels reported in 2000 and that the animal industry's share of the safe operating space for greenhouse gas emissions will rise from 52 percent as of 2000 to 70 percent by 2050 (Pelletier and Tyedmers 2010, 18372).

In terms of biogeochemical flows, reactive nitrogen mobilization would increase by 36 percent above levels reported in 2000, and the share of the safe operating space for reactive nitrogen mobilization will expand from 117 percent as of 2000, to 294 percent by 2050 (Pelletier and Tyedmers 2010, 18372). By 2050, nitrogen fertilization is projected to rise by 1.9 to 3.9, and phosphorus increase is estimated at 1.6 to 3.4-fold (Tilman et al. 2001, 283). Those increases will engender eutrophication of freshwater and coastal waters 2.4 to 2.7 times greater than in 2000 (Tilman et al. 2001, 281). Kahiluoto et al. conclude that "a radical transformation of agri-food systems using a broad range of means is imperative," particularly so because increasing efficiency in livestock production alone does not suffice to return to the safe operating space of biogeochemical flows (Kahiluoto et al. 2014, 20).

Whereas the scientific studies assess the technological mitigation potential differently, they agree on the necessity of lowering the consumption of animal foods. Hedenus, Wirsenius, and Johansson calculate that emissions may be kept to 7.7 gigatons of carbon dioxide equivalents per annum ($GtCO_2eq$/year) in 2070 if faster growth in livestock productivity is coupled with technical mitigation measures.[290] Yet, the authors maintain that "if structural changes in human diets are included, emissions may be reduced further, to 3–5$GtCO_2eq$/year in 2070. […] We conclude that reduced ruminant meat and dairy consumption will be indispensable for reaching the 2°C target with a high probability, unless unprecedented advances in technology take place." (Hedenus, Wirsenius, and Johansson 2014, 79). Nonetheless, the authors specify that "the

livestock sector (Gerber et al. 2013, xii, compare section 2.3.1).

290 Still, Hedenus, Wirsenius, and Johansson problematize the focus on higher productivity in intensified production, because it entails higher rates of nitrogen fertilizer application. More concretely, intensified livestock production implies, first, less grazing on permanent pasture and a higher share of oilseeds as feed which equals higher nitrogen fertilizer application rates. Second, intensified production and less grazing propagate a higher concentration of manure in stables, precipitating higher methane emissions from manure storage facilities. Third, intensified production and higher productivity in the dairy sector signifies that "less cattle meat (from surplus dairy calves and culled cows) per unit of milk is produced as a by-product." The authors calculate that the by-product cattle meat has less greenhouse gas emissions than cattle meat from suckler cow beef systems. "Given constant beef demand, this means that the higher the dairy cow milk yield, the higher the average GHG emissions per unit of total beef supply." (Hedenus, Wirsenius, and Johansson 2014, 85).

prospects for deep emission cuts in agriculture through technology seem unfavorable." Technology has limits, and even if technological options existed, their diffusion might be slow (Hedenus, Wirsenius, and Johansson 2014, 88). A "radical shift in diets" is thus needed (Hedenus, Wirsenius, and Johansson 2014, 86).

Bajželj et al. (2014b) calculate that sustainable intensification can cut 4 $GtCO_2eq$/year emissions; conversely, a moderate reduction in the consumption of animal protein would eliminate 5.6 $GtCO_2eq$/year emissions. In their article "Forecasting potential global environmental costs of livestock production 2000-2050," Pelletier and Tyedmers conclude that the application of technological means alone in the animal industry will not suffice to stay within planetary boundaries. Reducing the production of animal foods must be a policy priority (Pelletier and Tyedmers 2010).

Ripple et al. measure an emission reduction potential of 0.2–1.6 $GtCO_2eq$/year for higher livestock feeding efficiency, and a potential of 0.2–1.9 $GtCO_2eq$/year for enhanced crop yields. Reducing meat consumption, conversely, has a reduction potential of 0.7–7.3 $GtCO_2eq$/year. The mitigation potential of demand-side measures is thus much higher than the one of supply-side measures (Ripple et al. 2013, 3). The Fifth Assessment Report of the Intergovernmental Panel on Climate Change equally discusses studies on demand-side options to mitigate climate change, in particular substituting animal foods with plant-based products, termed "less GHG-intensive food" (Smith et al. 2014, 838):

> "Popp et al. (2010) estimated that agricultural non-CO2 emissions (CH4 and N2O) would triple by 2055 to 15.3 GtCO2eq / yr if current dietary trends and population growth were to continue. Technical mitigation options on the supply side, such as improved cropland or livestock management, alone could reduce that value to 9.8 GtCO2eq / yr, whereas emissions were reduced to 4.3 GtCO2eq / yr in a 'decreased livestock product' scenario and to 2.5 GtCO2eq / yr if both technical mitigation and dietary change were assumed. Hence, the potential to reduce GHG emissions through changes in consumption was found to be substantially higher than that of technical mitigation measures. Stehfest et al. (2009) evaluated effects of dietary changes on CO2 (including C sources / sinks of ecosystems), CH4, and N2O emissions. In a 'business-as-usual' scenario largely based on FAO (2006), total GHG emissions were projected to reach 11.9 GtCO2eq / yr in 2050. The following changes were evaluated: no ruminant meat, no meat, and a diet without any animal products. Changed diets resulted in GHG emission savings of 34—64 % compared to the 'business-as-usual' scenario […]. The analysis assumed nutritionally sufficient diets; reduced supply of animal protein was compensated by plant products (soy, pulses, etc.)." (Smith et al. 2014, 840).

5.7.4.2 Freshwater use

If the Livestock Revolution is to take place, agriculture will consume 13,500 km^3 water, almost twice the amount of water used today (Herrero et al. 2009, 116). In 2050, irrigated area will be 1.9 times bigger than in 2000 (Tilman et al. 2001, 283). Next to water use, the Revolution will add to water pollution (Deutsch, Lannerstad, and Ran 2011, 5; Gerber et al. 2013, 88; Thornton 2010, 2864). The pollution of water bodies and soil is, until now, "associated with industrial production systems" in the Minority World and their excessive amounts of manure and other waste. With the Revolution, water and soil pollution will deepen in the Majority World, too (Steinfeld 2004, 34).

5.7.4.3 Land-system change and change in Biosphere integrity

The Livestock Revolution will be accompanied by vast land-system change, or meat grab (Schneider), mainly to grow feed. One specificity of the Livestock Revolution is that the exploitation of pigs and chickens will outpace the exploitation of cows, hence, the share of pastures will relatively decline, and the share of cropland for oilseeds will comparatively expand (Herrero et al. 2009, 114).[291]

Weis has coupled FAO projections on land degradation with projected population growth. In 2050, 0.15 hectares of arable land will be available per person. In 2010, 0.21 hectares were available, and in 1961, 0.46 hectares of agricultural land were available per person (Weis 2010, 133). Tilman et al. estimate that in the Minority World, agricultural land area will shrink, and the area converted into agricultural land in the Majority World will expand. By 2050, this net loss of natural habitats in the Majority World—mostly in Latin America and Sub-Saharan Africa—will be as big as one billion hectares, an area greater than that of the United States. The combination of withdrawing agricultural land in the Minority World and adding land in the Majority World results in an average agricultural land base increase of 18 percent in reference to 2000 (Tilman et al. 2001, 283).

Wirsenius, Azar, and Berndes (2010) have simulated different scenarios for agricultural land use in 2030. The reference scenario of the FAO projects the extent of global agricultural land to rise to 5.4 billion hectares by 2030. Wirsenius, Azar, and Berndes calculate that higher efficiency in animal productivity could scale down this area to 4.8 million hectares by 2030. A shift from ruminant to monogastric meat would decrease land use to 4.4 million hectares, and a 25 percent decrease in meat consumption per capita in the Minority World plus less food waste would diminish the agricultural area to 4.2 million hectares (Wirsenius, Azar, and Berndes 2010, 637). Given the coupling of milk and beef production, it would have been interesting to

291 Schader et al. (2015) calculate the environmental impacts of reducing the share of food-competing feedstuffs.

include a vegan scenario.[292] As introduced in the chapter on planetary boundaries, a vegan diet has the potential to diminish land use by up to 50 percent (Hallström, Carlsson-Kanyama, and Börjesson 2015, 3). Machovina and Feeley have elaborated a scenario of a vegan diet, substituting meat with soy protein. In this scenario, animal production would not exist, and crops would be grown only for human consumption. As elaborated in part 2.4.1 on hunger, around 90 percent of energy is lost when plants are "converted" into animal foods. The authors deduce that a shift to a vegan diet would augment "the number of calories available for human consumption by as much as 70% — enough to feed an additional 4 billion people, exceeding the projected global population growth of 2 to 3 billion," without a single additional hectare of agricultural land. Further, even if animal products constituted ten percent of the human diet, the expansion of agricultural land would be stopped (Machovina and Feeley 2014).

The conversion of natural habitats into agricultural land always entails biodiversity loss (Machovina and Feeley 2014). Currently, meat production is emergent in tropical regions of the Majority World, where fifteen of the existing seventeen megadiverse countries are located. This meat grab will add an unprecedented biodiversity loss (Machovina, Feeley, and Ripple 2015). Even the Global Agenda—despite its assertion that livestock "improves" biodiversity—concedes that livestock is a "threat to biodiversity in 306 of the 825 ecoregions" (Global Agenda for Sustainable Livestock 2014b, 7).

292 A reduction in milk consumption, for example, does not necessarily curtail land-use change. Wirsenius, Azar, and Berndes explain:
"Increasing the milk yield of dairy cows does not in itself lead to significant land savings as long as beef demand remains unchanged, since the lower production of dairy beef that follows from higher milk yields has to be compensated by a higher production of more land-demanding beef cattle meat. To fully exploit the land savings of increased milk yields, therefore, beef demand must decrease to the same extent as the decrease in dairy cattle beef supply." (Wirsenius, Azar, and Berndes 2010, 637).

6 CONCLUSION

6.1 Summary

This thesis enquired about the discourses and structures fueling the Livestock Revolution, a planned upsurge in the consumption of animal foods of around 70 percent by 2020 which is expected to continue to 2050. It scrutinized its supposed inexorableness and its consequences for animals, society, and the environment.

The two hypotheses were that the Livestock Revolution universalizes the Minority World's meatified production and consumption systems and that the *sustainable exploitation* of farmed animals, while benefitting capital interests, aggravates current social and ecological crises.

Nearly one hundred documents on the Livestock Revolution have been explored following Hajer and Keller, from the Revolution's first definition in 1999 in a publication by the International Food Policy Research Institute, the International Livestock Research Institute, and the Food and Agriculture Organization of the United Nations, to current papers, predominantly issued by international institutions, as well. The analysis has been embedded in an examination of the wider context of the Revolution, the animal-industrial complex, and in a theoretical investigation of green capitalism. The engagement with existing literature on the subject and with the data has resulted in proposing a mirror move of naturalization and capitalization.

The discourse analysis laid bare the discursive legitimizations and structural conditions of the Revolution. It showed that the widely shared biologistic assertion that population growth, income increase, and urbanization in the Majority World provoke an increasing consumption of animal protein conceals the discursive and structural settings of the Revolution. It demonstrated that the Revolution is not inevitable but rather a process promoted in view of stagnating turnovers in the Minority World: the Minority World still consumes three times more animal foods than the Majority World, nonetheless, the center of gravity is shifting. The concomitant universalization of the imperial diet, global meatification, is profitable for exporting countries from the Minority World and agribusinesses that transfer knowledge, technology, and whole production systems to the Majority World. Industrial livestock operations now provide around 80 percent of animal foods and have largely overridden pastoral and mixed systems. Such livestock industrialization is accompanied by the narratives of modernization, poverty alleviation, food security, and environmental value—storylines that unite actors as diverse as UN institutions, development agencies, pharmaceutical research companies, meat corporations, social

movements, and animal and environmental protection organizations in one, unison discourse coalition.

The concept of *sustainable exploitation* summarizes the two chief characteristics and effects of the current and future development in animal agriculture as proposed by the Livestock Revolution. First, the term *exploitation* underscores the bloody and brutal character of the complex and its detrimental effects not only on farmed animals but on workers, communities, and nature, too. Second, the term *sustainable* promises environmental stewardship, green growth, and social equity and thus has an appealing, "progressive" green façade. However, behind this façade, there are imperial origins and (neo-)colonial practices.

Sustainable exploitation equals systemic and unprecedented violence perpetrated on farmed animals, both on a quantitative and qualitative scale. In the last fifty years, the number of slaughtered animals multiplied more than eightfold to roughly 70 billion individuals, and the Revolution is supposed to increase this number to 120 billion. The sustainable aspect adds environmental violence to the suffering of the sentient beings treated as "renewable resources" or "primary inputs" of the complex.

On a societal level, sustainable exploitation perpetuates the enormous amount of resources used by the industry which advances hunger and water stress, the colonization of new territories (the sector already covers 45 percent of global land surface), climate injustice, brutal work and health conditions, and environmental racism. It penalizes subsistence agriculture and pastoral systems for their high emission intensities and unsophisticated technology, and it reproduces global power structures when small-scale farmers cannot comply with the (environmental) standards of agribusiness and are asked to either intensify production or provide "environmental services."

The environmental impact of the livestock sector is equally without precedent—it is one of the main drivers of climate change, biodiversity loss, land-system change, biogeochemical flows, ocean acidification, and freshwater use. The ecological hoofprint of a carnivore diet is more than twice as big as that of a vegan diet. The projected Revolution alone—without including any other global sectors, like energy or transport—would engender a global warming of two degrees Celsius by 2050 (and not 2100, as the Intergovernmental Panel on Climate Change predicts). It is unresolved where the necessary resources and land should be taken from to grow crops or where to create pasture to propel the "nutrition transition." Still, the eco-modernist discourse of sustainable exploitation feigns a feasible future of unfettered expansion and resource exploitation.

In sum, sustainable exploitation aggravates the socioecological crisis, however, the green veneer distracts from these new forms of control, oppression, and business opportunities: the label "enlightens," reforms, and legitimizes the commoditization of farmed animals with sporadic animal welfare policies; it enlightens structural change in the food system as "poverty alleviation" and the destruction of large flows of cereals as the (humanitarian) provision of essential animal protein; and it enlightens continuing environmental degradation through emission certificates. This enlightened, sustainable exploitation naturalizes and capitalizes on the Livestock Revolution, universalizes the industrial meat regime, and continues the imperial past of sustainable development.

6.2 Implications

What are the implications of the Livestock Revolution and sustainable exploitation? The enlightened green label assigned to the various aspects of livestock production and the unified discourse coalition make dissent almost impossible. The Livestock Revolution discourse is in its uniformity highly successful. At the same time, paradoxical statements on the Revolution's effects, such as it being both danger and opportunity, magnify, like alternative facts, the distraction and confusion and complicate a determined intervention. The paradoxes are entrenched in ecological modernization theory's equally ambivalent market optimism coupling economic growth and environmental stewardship.

The animal-industrial complex is ingrained in contemporary capitalist society and affects people on an economic, cultural, and emotional level. Though this entanglement is contingent and ever-changing, it is exceptional to find a counterhegemonic perspective in the discourse. Similarly, the green economy is a powerful imaginary and has quieted some of its early critics. Fritz poignantly formulates that one of the biggest challenges in the Livestock Revolution, much more than tackling climate change, is to dismantle the symbolic power of the Minority World's meat consumption (Fritz 2014, 15). For Weis, "the need to challenge and reverse the race towards greater meat consumption emerges as an essential aspect of struggles for a more equitable and sustainable world" (Weis 2013b, 67).

Nevertheless, given the magnitude of animal production, and the all-embracing nature of discourse, who has the power to intervene? A fruitful starting point could be the marginalized perspectives of critical animal studies and decolonial political ecology. To reach the core of the issue, an intersectional, multi-optic vision (Kim 2015) is needed, addressing the diverse forms of oppression in the complex, and the structures that benefit from it. Above and beyond, it is crucial to reveal that the animal-industrial complex's primary aim is not to produce food but to

make money (Gunderson 2013, 260–61). Likewise, Schneider defines meat not as food, but as capital, given that industrial meat equals corporate livestock, and thus capital accumulation:

> "industrial meat represents the diversion of calories, soil nutrients, water, fossil fuels, research funds and focus, and labor away from possibilities for producing food and livelihoods for people in an equitable and sustainable way, and towards feeding corporate livestock, which in turn feeds capital accumulation. In both a material sense (related to the physical use of land and resources to produce feed and industrial meat rather than food) and an ideological sense (related to modernist notions of 'dietary transitions' that include increased meat consumption) meat is a category that elides easy classification as simply the food of food security. The space created between nutrient and energy losses when grains and oilseeds are converted into meat is a political, as well as a metabolic, space." (Schneider 2014, 615).

The political aspect Schneider evokes is vital. The Livestock Revolution is not a matter of fate but a question of power and capital interests. If there is no resistance and conflict, the Revolution might essentially take place—a Revolution whose form is to be determined, yet one thing is certain: its biophysical contradictions will persist. From an ecological perspective, this imperial mode of living cannot be generalized (Brand and Wissen 2012, 554). Given that infinite growth in a finite world is an impossibility, green capitalism is degrading its own resource base. As much as ecological modernization wants to make us believe it, planetary boundaries cannot be technologically managed or regulated with the market.[293] Equally, as much as the Revolution wants us to believe that there is no alternative to meatification, it is not a biological necessity, not all societies have to follow one unidirectional path and buy into imperial meat or milk, and sentient beings are not primary inputs.

To apply Audre Lorde's dictum "the master's tool will never dismantle the master's house" (Lorde 2007, 110) in a dissimilar context: instead of overpowering the crisis with even more meat, technology, and growth, the present deconstruction of sustainable exploitation implies the need for a different approach to the interconnected ecological and social crisis, the need for a wholly altered food system, and the necessity of a renunciation of this imperial mode of living.

6.3 Evaluation and directions for future research

What are the limitations of the present "political ecology of the Livestock Revolution"? They are located on the planes of individual perspective, methods, academic discipline, and thematic focus.

293 Interestingly, the planetary boundaries team was criticized for not addressing their prioritization of natural factors enabling human survival over other conditions, such as economic ones. The team answered:
"Critics have suggested an additional normative dimension, that the biosphere is the basis for human wellbeing. We argue that this is no longer a normative issue for argument, but rather a fact based on empirical evidence." (Rockström 2015).

The first constraint is the author's perspective. As much as a writer's reflection on their own position enables insights, it also obstructs them. As outlined in the introduction, the author's privileged position as a white Minority World inhabitant engenders a specific comprehension of and attitude towards the subject. All privilege is ignorant at its core, and reaching epistemological decolonization, as demanded by Quijano, is a difficult, long, and permanent process. In addition, from the standpoint of discourse theory, there is no place outside the discourse. Accordingly, the dissertation is a child of its time. For instance, in sections on the ecological hoofprint, the thesis does not necessarily encounter ways of grasping or depicting nature other than as compartmentalized ecosystems.

There is no definite remedy to those issues, as leaving one's standpoint and deleting one's own experience or history is futile. Nevertheless, it is feasible to reflect on one's background and to unlearn certain modes of thinking. This endeavor needs exchange with and critique from other perspectives to retrieve the blind spots in one's analysis.

A second limitation of such an exploration of policy papers is that exploring the actual implementation of pro-poor policies or environmental regulations and their effect on the ground is out of scope. By the same token, this dissertation performs an analysis of the Livestock Revolution *discourse* from 1999 to 2016—and not an extensive empirical (say, statistical) investigation of when and how the Revolution will unfold (although chapter five comprises some hints in this direction from its analysis of discourse fragments). The lack of such additional data on the future of livestock expansion entails that the question *if* the Livestock Revolution will take place for good cannot be fully answered.

Hence, future research could include quantitative methods or additional qualitative studies that, in contrast to the present strand of discourse analysis, do not rely on already published and publicly available documents but instead generate data themselves. Possible qualitative courses of action could include (expert) interviews with representatives from international institutions such as the International Food Policy Research Institute or the FAO, multi-stakeholder partnerships such as the Global Agenda, researchers, corporations, lobbies, and non-governmental organizations, and with producers themselves; or participant observation at relevant field sites (pastoral communities, research institutions, or headquarters of lobby organizations, to name a few).

Third, the interdisciplinary nature of the subject has both advantages and disadvantages. In the thesis, sociological theory meets agronomic statistics, and veterinary medicine clashes with climatology. This variety does justice to the many facets of the animal-industrial complex. Yet it

must be acknowledged that the author's background in social sciences restricts to a certain degree a critical investigation of insights from other disciplines. Nonetheless, this constraint should by no means discourage such an interdisciplinary endeavor. Far too often, social sciences do not attempt to problematize the material circumstances of society, namely global ecological processes, and hence leave the playing field to the natural sciences. These latter, in turn, lack an understanding of societal dynamics. This dissertation's approach to socio-ecological relations commands a critical examination of technology, ecology, and their disciplinary vocabularies, which are generally void of power and politics (Hornborg 2009, 238, 240).

In this regard, both disciplinary and interdisciplinary research on the Livestock Revolution are necessary. The present analysis can be complemented by a further examination of the political and economic factors propelling the Revolution, for instance concentrating on the role of foreign direct investment in selected countries. In the same way, the critical investigation of the causes of the Revolution by Pica-Ciamarra and Otte (2009) can be carried on. What virtually all discourse fragments left unmentioned was that population growth demands a surge in cereal production by 50 percent by 2050, yet, nobody speaks of a "Cereal Revolution." What are the reasons for this omission and the sole focus on the livestock industry?

Furthermore, a complete study of the influence of animal farming on the crossing of planetary boundaries would be highly instructive. Such a project could be accompanied by comparing this impact with the contribution of a vegan diet. This appraisal would add to research on the mitigation potentials of the demand-side, instead of propagating the already existing literature on the supply-side. An asset in natural science publications would be the inclusion of societal undercurrents. Overall, work from critical animal studies could take account of the situation of farmed animals and thus add complexity and depth to a discussion of the Revolution.

The fourth and last limitation is on the thematic plane. The global focus of the thesis enabled to fully envisage the similarly broad Livestock Revolution discourse and global power dynamics. However, there are also the downsides to the simplification, generalization, and disregard of regional, national, or cultural differences. The dilemma is manifest in the dichotomy Majority/Minority World as well. Likewise, the dissertation reverberated the discourse's use of "the poor" or "smallholders," terms that can essentialize and simplify reality, ignore context and the intersectional nature of identities.

In consequence, additional research is welcome that focuses on the concrete repercussions of the Livestock Revolution in specific contexts, regions, cultures, and for people of different identities, backgrounds, classes, races, genders, religions, and so on. Here, the concepts of imperial

meat and imperial milk that arose in this dissertation could be further developed and fleshed out. Moreover, the discursive actors of the Livestock Revolution were rendered as unified in one discourse coalition. Whereas this holds true, the actors themselves and their interests diverge heavily. Studies could embrace the range of the sector's different stakeholders.

Finally, the thesis disclosed the hegemonic discourse of the Livestock Revolution. Future investigations could, in contrast, reveal the various forms of resistance against this expansion of the animal-industrial complex. Those rebellions happen on numerous levels, including the societal, animal, and environmental, and both in the Minority and Majority World. Research shedding light on these acts of resistance can also contribute to a rupture of the dominant discourse and of the ontologization of oppression.

The Livestock Revolution is not only a drastic change in agricultural production; it is a perpetuation of an imperial mode of living. It maximizes capital accumulation by maximizing "sustainable" animal exploitation and violence. The far-reaching consequences of the Livestock Revolution demand an equally radical response. Indeed, if the Revolution goes unchallenged, this profit-driven attack on so many lives turns into a war on life as such.

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APPENDIX 1: SAMPLE OF THE DISCOURSE ANALYSIS

Compare section 4.2.2, Methods.

The clusters serve as an orientation only. Some articles can be assigned to multiple clusters (for instance, in the case of an FAO publications on Asia). The references are ordered chronologically. Those publications that are not quoted in the dissertation and the bibliography are marked with an asterisk.

SAMPLE A: THE LIVESTOCK REVOLUTION

1 ORIGINAL LIVESTOCK REVOLUTION REPORT

Delgado, Christopher, Mark Rosegrant, Henning Steinfeld, Simeon Ehui, and Claude Courbois. 1999. “Livestock to 2020: The Next Food Revolution: Food, Agriculture, and the Environment Discussion Paper 28.” International Food Policy Research Institute; Food and Agriculture Organization of the United Nations; International Livestock Research Institute. Accessed March 24, 2011. www.fao.org/Ag/againfo/resources/documents/lvst2020/20201.pdf.

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SAMPLE B: THE GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK

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APPENDIX 2: MEMBERS OF THE GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK

Compare section 4.2.2.2.2 on the presentation of actors.

This list combines information from news announcements from the Global Agenda for Sustainable Livestock (Global Agenda for Sustainable Livestock 2016a, 2016c) and from the Global Agenda's homepage section "Partners" as of December 30, 2016 (Global Agenda for Sustainable Livestock 2016d). It is nowhere specified to which of the seven clusters a specific member pertains. This table is a detailed proposal to structure the members in clusters, and in their origins—stemming from either the Majority, or Minority World (table 4 in section 4.2.2.2.2 provided an overview of the present categorization). Despite its potential flaws,[294] the structure offers an overview of the diverse clusters and their respective weight in the Agenda. The additional information provided on the actors stems from their respective homepages. Whenever the institution is of multinational nature, its headquarters are listed.

Cluster	Minority World	Majority World
1 Public sector **Total: 16** **Minority World: 6** **Majority World: 10**	1. GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit, Germany 2. Government of France, France 3. Government of Ireland, Department of Agriculture, Food and the Marine, Ireland 4. Ministry for Primary Industries, New Zealand 5. Ministry of Economic Affairs, The Netherlands 6. Government of Switzerland, represented by the Swiss Federal Office for Agriculture, Switzerland	1. Government of Dominican Republic, Ministry of Agriculture, Dominican Republic; and Dirección General de ganadería, (Department of the Cattle Industry) Dominican Republic 2. Government of Rwanda, Ministry of Agriculture and Livestock, Rwanda 3. Ministerio de Desarrollo Agropecuario, Panama 4. Government of El Salvador, Ministry of Environment and Natural Resources (MIDA ministerio de medio ambiente de El Salvador) 5. Government of Uganda, Uganda Bureau of Statistics 6. Government of Kenya, Ministry of Agriculture, Livestock and Fisheries; Directorate of Livestock Production, Busia County; Kenya Dairy Board (statutory organization mandated by an Act of Parliament) 7. Government of Costa Rica,

294 The structuring is a putative one, and the lines between the cluster academia/research, NGOs, and social movements are blurred. Consequently, the structure must be taken with a grain of salt.

		Ministry of Agriculture and Livestock 8. Government of Cuba, Ministry of Agriculture and Livestock 9. Government of Ethiopia, Ministry of Livestock and Fisheries 10. Government of Paraguay, Ministry of Agriculture and Livestock
2 Private sector **Total: 16** **Minority World: 15** **Majority World: 1**	1. Animal Task Force, based at the "Maison Nationale des Eleveurs," France "*The stakeholders from industry and research from across Europe inform about their goals, activities, and their organisation*." *Public-private platform.* 2. European Livestock and Meat Trading Union, European Union *"The EU voice of national federations representing livestock markets, livestock traders (cattle, horses, sheep, pigs), meat traders (beef, horse meat, sheep meat, pig meat), and the meat industry (slaughterhouses, cutting plants, meat preparation plants)."* 3. Global Dairy Platform (listed as *Global Initiatives*), United States of America *"Global Dairy Platform leads the development of a collaborative, unified approach on common industry issues and the nurturing of innovative research so that consumers value milk and dairy products as naturally nutritious, enjoyable and an essential part of a healthy diet. Our membership of CEOs, executives and researchers from corporations, communication and scientific bodies work in partnership to align and support the dairy industry in the promotion of sustainable dairy nutrition. "* 4. Global Roundtable for Sustainable Beef, The Netherlands/United States Its executive committee comprises of the (almost all white and male*) president, a representative of the *Canadian Cattlemen's Association*, the Vice President, of the *World Wildlife Fund,*	1. Association pour la Promotion de l'Elevage au Sahel et en Savane (APESS), Burkina Faso "*Fondée en 1989 à Bobo Dioulasso au Burkina Faso, l'Association pour la Promotion de l'Elevage au Sahel et en Savane (APESS) est aujourd'hui une organisation internationale d'éleveurs d'Afrique de l'Ouest et du Centre."*

	The Secretary-Treasurer, of *Elanco*, and the two "members at large" are representatives of *McDonald's Corporation* and *JBS, USA*. 5. International Dairy Federation, Belgium *Represents the global dairy sector* 6. International Egg Commission, United Kingdom 7. International Feed Industry Federation, Germany/Luxemburg 8. International Meat Secretariat, France *Represents the global meat and livestock sector* 9. International Poultry Council, United States *"Bringing together poultry leaders from around the world"* 10. Novus International, United States of America *Animal health and nutrition company, producing e.g. feed preservatives* 11. The Canadian Cattlemen's Association, Canada 12. Ranch 4 International Ltd, Canada 13. Turkey Farmers of Canada, Canada 14. Van Drie Group, The Netherlands 15. Country Carbon, Australia	
3 Academia/research organizations **Total: 28** **Minority World: 17** **Majority World: 11**		
Universities Total: 15 Minority World: 6 Majority World: 9	1. Bern University of Applied Sciences, HAFL, Switzerland 2. CIRAD. Centre de Coopération Internationale en Recherche Agronomique pour le Développement, France *"The French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions."* 3. INRA, Institut National de la Recherche Agronomique, France 4. Royal Veterinary College, University of London, United Kingdom 5. Swedish University of Agricultural Sciences, Sweden	1. Beijing Environmental Asset Management Consultancy Centre, China 2. CATIE, Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica 3. Instituto Plan Agropecuario, Uruguay 4. National Institute of Animal Sciences, Thuy Phuong, Tu Liem, Ha Noi, Viet Nam 5. SAVES, Society of Animal, Veterinary and Environmental Scientists, Pakistan 6. Universidade Federal de São João del-Rei, Brasil 7. Universidad Nacional de la

	6. Kansas State University - College of Veterinary Medicine, United States	Patagonia Austral, Argentina 8. Instituto Nacional de Tecnología Agropecuaria (INTA) Argentina 9. El Colegio de la Frontera Sur (ECOSUR), Mexico
Consultancies / private research centers Total: 13 Minority World: 11 Majority World: 2	1. ATB, Leibniz Institute for Agricultural Engineering Potsdam-Bornim, Germany *"The Leibniz Institute for Agricultural Engineering and Bioeconomy is a nationally and internationally acting research center at the interface of biological and technical systems. Our research is aimed at sustainable intensification. We analyze, model and evaluate bio-economic production systems. We develop and integrate new technologies and management strategies for a knowledge-based, site-specific production of biomass, and its use for food, as raw materials and fuels - from basic research to application. Thus we are contributing to food security, animal welfare, the holistic use of biomass, and to protect the climate and environment."* 2. FBN, Leibniz Institute for Farm Animal Biology (Leibniz-Institut für Nutztierbiologie), Germany (member of the Leibnitz-Society) 3. Agri benchmark, Germany *"Agri benchmark is a global, non-profit network of agricultural economists, advisors, producers and specialists in key sectors of agricultural and horticultural value chains. agri benchmark is a non-political and non-profit activity."* 4. AgResearch, New Zealand *"AgResearch partners with the pastoral sector to identify and deliver the innovation that is needed to create value for New Zealand. It is a vibrant organisation with staff spread across four campuses and farms in the Waikato, Manawatu, Canterbury and Otago."* 5. Institut de l'Elevage, France *"The French Livestock Institute (short name Idele) is a non-profit, non-governmental R&D organization appointed by the French ministry of agriculture as*	1. CIPAV, Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria, Colombia 2. Fundación Produce Michoacán, Mexico

	technical center for agriculture (member of ITA network). It is the national reference and normative body in livestock farming systems." 6. LIFE, Local Livestock for Empowerment of Rural People *"Local Livestock For Empowerment (the LIFE Network) is an action research and advocacy network of organizations and individuals who are concerned about the future of local livestock breeds, and about the people who rely on these animals for their livelihoods."* *"The LIFE Network consists of a core group of active members and a wider network of supporting partners who adhere to a common Charta. It has a board, a secretariat and regional coordinators for Africa and Asia.* *Membership is open to non-government organizations working at the grassroots level, herders' associations, scientists, volunteers and individual supporters."* *Its international office is based at the "League for Pastoral Peoples and Endogenous Livestock Development" secretariat in Germany; LIFE equally has a contact in India and Kenya.* 7. LIFLOD, Livestock Farming and Local Development Network (LIFLOD has no proper secretariat) *"Livestock farming and local development network (LiFLod) is a strategic partnership between researchers, farmers, development agencies and other stakeholders dedicated to understanding and analyzing the relationships between livestock farming and sustainable local development.* *This network aims to bring together groups from different countries to contribute to the debate on the future of livestock farming, focusing particularly on the interactions between livestock farming and local development. "* Members: Waquil Paulo (animal sciences), Federal University of Rio Grande do Sul Homem Valéria (veterinary), Ministry of Agriculture; Belgium: Lambin Eric (livestock geography), Univ. Louvain la Neuve; Burkina Faso: Aliou Ibrahima (livestock	

	development), APESS; Cameroon: Aboubacar Njoya (animal sciences), CORAF; Canada: Woodrow Maureen, Univ. Ottawa; China: Long RuiJun (livestock sciences), Univ. Lanzhou; France: Dedieu Benoit (livestock systems sciences), INRA, Ickowicz Alexandre (livestock systems sciences), CIRAD, Manoli Claire (veterinary), INRA-CIRAD, Tourrand Jean François (livestock systems sciences), CIRAD, Derkimba Adeline (livestock systems sciences), INRA-CIRAD; Italy: Gerber Pierre (livestock geography), FAO AGAL; Kenya: Herrero Mario (livestock sciences), ILRI; New Zealand: Paine Mark (livestock sciences), DairyNew Zealand, Wedderburn Liz (livestock systems sciences), AgResearch; Senegal: Ly Cheikh (livestock economy), EISMV; Uruguay: Morales Hermes (livestock systems sciences), Inst. Plan Agropecuario. 8. VetEffecT, The Netherlands *"A Dutch company with many years of expertise in veterinary and dairy management."* *"Our mission is to contribute to healthy people and healthy animals in balance with the environment.* *We support organisations with ideas and knowledge turned into actions. These actions are based on key success factors: on sound professional knowledge and experience of animal health and food safety, dedicated project implementation based on established project management techniques, and knowing what it takes to let people work together."* 9. Savory Institute, United States *"The Savory Institute facilitates the realization of a life of enduring returns for the land and all who depend on it. The Institute is the brain trust of the organization. We develop innovative tools and enhanced curricula, inform policy, establish market incentives, increase public awareness, and coordinate relevant research, cultivating relationships with aligned partners."* *"The Savory Institute engages many*	

	different audiences to change public perception that livestock itself causes the degradation of grasslands. It is actually the way humans manage livestock that is the culprit. This fundamental shift in thinking must happen to drive needed policy and market shifts." 10. TAFS Forum, Switzerland *"The TAFS forum was founded in 2002 as the International Forum for **T**ransmissible Spongiform Encephalopathies (TSE) **a**nd **F**ood **S**afety, in response to the urgent need to address the BSE/TSE issue." "The TAFS forum is an independent, Swiss-based forum, with international membership, dedicated to studying, reporting and making recommendations on controversial and emerging issues relating to the safety of food derived from animals. Our activities include scanning the horizon for new risks, assessing the level of risks for the food industry, and recommending risk management. We bring together scientists, industry, regulators and consumers in the TAFS forum to facilitate the understanding of these issues by policy-makers, politicians, the scientific community, journalists and members of the public."* 11. IFCN Dairy Research Network, Germany *"We are the leading, global knowledge organisation in milk production, milk prices and related dairy economic topics."*	
4 Donors **Total: ?**	?	?
5 NGOs Defined as "representatives from interest groups such as animal welfare and environmental or livelihood non-governmental organizations" (Global Agenda for Sustainable Livestock 2016b). **Total: 9** **Minority World: 8**		

Majority World: 1		
Animal welfare organizations	1. Compassion in World Farming, United Kingdom 2. Humane Society International (affiliates in Canada, Europe, India, Latin America, the United Kingdom, and the United States), United Kingdom 3. World Animal Protection, United Kingdom 4. Veterinaries Without Borders-Switzerland	
Livelihood organizations	1. Heifer International, USA	
Environmental organizations	1. Inter Eco Center, Ukraine 2. The Nature Conservancy, United States 3. World Wildlife Fund, Switzerland	1. Fundación CoMunidad, Panama
6 Social movements and community-based organizations Defined as "representatives of pastoralists, indigenous people, agricultural workers, small farmers and peasants" (Global Agenda for Sustainable Livestock 2016b). It is in some cases complicated to distinguish between research institutions and social movements.		
Total: 4 **Minority World: 1** **Majority World: 3**	1. League for Pastoral Peoples and Endogenous Livestock Development, Germany	1. Redes Chaco, WAMIP (Alianza Global de Pastoralistas), Argentina 2. WAMIP North Africa 3. Pacto Coqueta: Cero Deforestación y Reconciliación Ganadera, Colombia
7 Inter-governmental and multi-lateral organizations Defined as "institutions that have a mandate in livestock sector development" (Global Agenda for Sustainable Livestock 2016b) **Total: 7** **Minority World: 4** **Majority World: 3**	1. FAO, Rome *(initiator)* 2. The World Bank, Washington DC 3. Pastoralist Knowledge Hub (FAO) "*The Hub is hosted by FAO and combines the organization's expertise in livestock production with its knowledge on civil society and indigenous peoples.*" 4. World Organization for Animal Health, OIE, Paris	1. African Union – Inter-African Bureau for Animal resources, Kenia "*The African Union Inter-African Bureau for Animal Resources (AU-IBAR) is a specialized technical office of the African Union. It was established in 1951 and was initially known as the Inter-African Bureau of Epizootic Diseases. Initially it was mainly concerned with rinderpest control, but its mandate was expanded to other major animal diseases in 1956 and finally to all aspects of animal resource development in 1970. The 2005-2007 AU/IBAR programme is focused on Animal Health and production as*

		well as trade and markets." (Source: WHO). 2. ILRI, International Livestock Research Institute *"ILRI is an international research institute with its headquarters in Kenya and co-hosted by the Government of Ethiopia in Addis Ababa. It works through a network of regional and country offices and projects in East, South and Southeast Asia, Central, East, Southern and West Africa, and in Central America"* *"ILRI is a CGIAR research centre [Consultative Group for International Agricultural Research], a global research partnership of 15 centres working with many partners for a food-secure future."* 3. African Development Bank

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Global Agenda for Sustainable Livestock. 2016a. "21 New Members Join the Global Agenda during and After the 2016 Panama MSP." Accessed December 23, 2016. http://www.livestockdialogue.org/news/news/october-2016/21-new-members-join-the-global-agenda/en/.

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APPENDIX 3: QUANTITATIVE ANALYSIS OF THREE DISCOURSE FRAGMENTS

Compare sections 5.4.4 and 5.5.1 of the discourse analysis.

Discourse fragment	Sustain- *-able, -ibility*	On poverty *Poor/ poverty*	Rich	Economic growth	Efficien- *-t, -cy*	Manage- *-ment*	Technolog *-y, -ies, -ical*	Animal welfare	Modern- *-ity*	Nature	Natural resources	Environment- *-al*
Livestock to 2020 (1999) 65 pages incl. annex	17	**85** (72/13)	14	13	8	4	21	1	0	0	1	20
Tackling Climate Change (2013) 107 pages incl. annex	24	7 (3/4)	1	4	**96**	**153**	**82**	4	2	0	17	40
Global Agenda Action Plan (2015) 55 pages incl. annex	**155**	3 (0 /3)	0	7	**48**	9	11	8	1	0	**17**	**60**

(The counts include footnotes, but not abbreviations or references)

Delgado, Christopher, Mark Rosegrant, Henning Steinfeld, Simeon Ehui, and Claude Courbois. 1999. "Livestock to 2020: The Next Food Revolution: Food, Agriculture, and the Environment Discussion Paper 28." International Food Policy Research Institute; Food and Agriculture Organization of the United Nations; International Livestock Research Institute. Accessed March 24, 2011. www.fao.org/Ag/againfo/resources/documents/lvst2020/20201.pdf.

The 65-pages report has a clear focus on "the poor" and "poverty alleviation." It is notable that "the rich" are also mentioned, yet often in hedged prose ("the richest," "richer"). Animal welfare is almost never evoked. The environment is not a priority; "natural resources" are only mentioned once. If "sustainable" is used, then it is used predominantly as "sustainable intensification" or "sustainable agriculture." Only four references of "manage" appear, focusing on "risk management." The document counts 20 times "environment" is mentioned, with a focus on "environmental problems" and "environmental challenges."

Gerber, Pierre, Henning Steinfeld, Benjamin Henderson, Anne Mottet, Carolyn Opio, Jeroen Dijkman, Alessandra Falcucci, and Giuseppe Tempio. 2013. *Tackling Climate Change Through Livestock: A Global Assessment of Emissions and Mitigation Opportunities.* Rome: FAO. Accessed November 15, 2013. http://www.fao.org/ag/againfo/resources/en/publications/tackling_climate_change/index.htm.

Tackling Climate Change (107 pages including annex) is a report on mitigation options for climate change and shows a very different picture. The "poor" are only mentioned seven times. "Poverty" is referenced four times, highlighting the sector's importance for "food security and poverty alleviation." "Poor people" or "poor households" are mentioned three times throughout the report. The references largely occur in the foreword, introduction and conclusion. Nonetheless, it is worth noting that a concrete contribution or a more specific account of how mitigation efforts can benefit "the poor" are missing. "The poor" seem to be attributed a bit more importance than "animal welfare" (mentioned four times), but they are astonishingly absent from the report – although it is stated in the foreword that the report "identifies ways of reducing emissions by assessing the mitigation potential of sets of technologies. Such analysis provides guidance for local and system-specific solutions, as sector actors seek to improve sustainability and viability, but also for more targeted pro-poor livestock development" (Gerber et al. 2013, ix). "Vulnerable households" are also just mentioned once in the report. "Pastoralists and smallholders" are cited twice. "Manage"/"management" is quoted 153 times. Similarly noticeable are "efficient" and "technology." "Sustainability" is mentioned 24 times, chiefly in the foreword, introduction, in the chapter on policy, and in the conclusion, which implies a rather rhetorical function in the report. "Animal welfare" is referenced four times already. The report never uses the

word “nature,” but speaks of “environment” (cited four times). The term of preference is “natural resources” (17 times), mainly in combination with “natural resource use.” “Natural habitats” show up twice. “Environmental issues,” “environmental impact,” “environmental gains” and others are mentioned 40 times, “environmental service provision” once, and “environmental sustainability” twice.

Global Agenda for Sustainable Livestock. 2015a. “Action Plan 2016-2018: Facilitating dialogue, generating evidence and adopting good practices in support of the UN Agenda 2030 for Sustainable Development.” Version 16 November 2015. Accessed June 12, 2016. http://www.livestockdialogue.org/en/.

While it is obvious that the word “sustainable” would feature prominently in the report due to the name of the Agenda and the connection to the UN Sustainable Development Goals, its count of 155 mentions in 55 pages is still overwhelming. “Sustainable” appears mainly as “sustainable development,” but also, and this is novel, as “sustainable sector development,” “sustainable livestock,” and “sustained growth.” “The poor” have completely disappeared from the Global Agenda’s Action Plan, the impersonalized “poverty” appears three meagre times. “Natural resources” are cited 17 times. The “environment,” however, shows up 60 times, mostly as “environmental impact” or “environmental issues,” but as, and this is new as well, “environmental assessment,” “environmental indicators,” or “environmental accounting,” and as “environmental performance,” and “environmental services.” “Animal welfare” is evoked eight times.