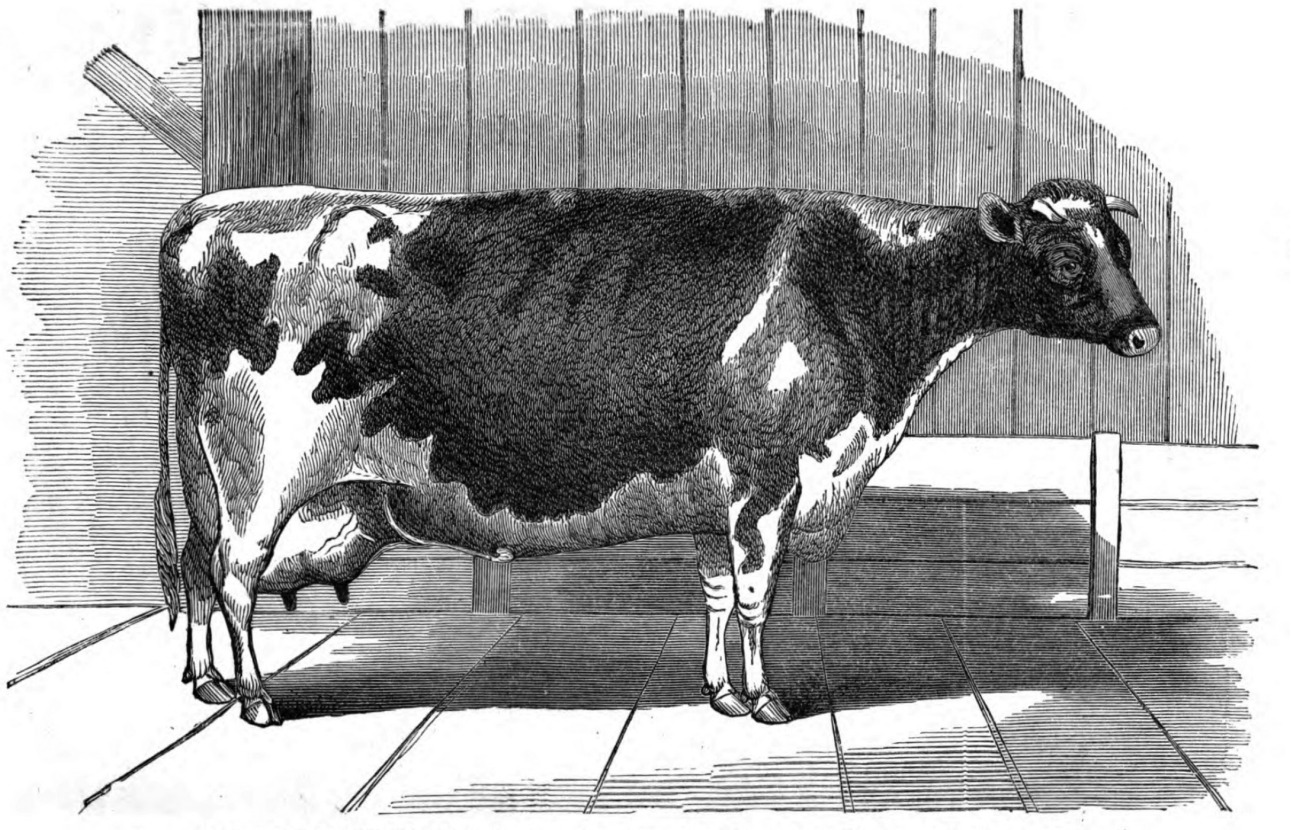
Genes, Robots, and Toxicity: the Haunted Landscapes of Milk Production



Texelaar, Holstein cow imported from North Holland by Winthrop W. Chenery
Source: Chenery 1872

Víctor Muñoz Sanz

This comprehensive essay looks into the relationship between humans and Dutch dairy cattle, which of course involves exploitation and cruelty. Víctor Muñoz Sanz aims to »think along how we stopped caring about our cows as companions and how to move forward.« Introducing the concept of cow's »Five Freedoms« – freedom from hunger, discomfort, pain, and stress, and to express their natural behavior, he exposes these codes that were released from the UK Farm Welfare Council in the nineteen-sixties as one reason to justify automated solutions for dairy farming. Today, with increasing ammonia emissions, the industry with its violent modern reproduction methods along with its automated barns is confronted with demands from NGOs for drastic measures: cutting the farm-animal population by half to protect nature and biodiversity. According to Sanz, this is the industry's »battle against its own ghosts and monsters,« again clashing with the interests of the animals involved.

> The Dutch cows have been a long time celebrated for their abundance of milk, which does not surprise one in looking at the rich polders in which in summer they are fed, and where they are often seen covered with a cloth as a protection against both the dampness and the cold ... They are generally of a black-and-white color; in some cases they are milked three times a day ... They remain in pasture all summer, where they are milked; but in winter they make a part of the family, and, in truth, live in the common eating-room of the family, it being a part of the main house. The cow stalls, while occupied by the cows, are frequently washed with water ... Indeed, the neatness of all their arrangements is perfect.
> —Henry Colman, as quoted in Chenery 1872 [1]

> Hundreds of Dutch farmers have been protesting against calls to curtail nitrogen emissions from the farming sector. The government is being urged by MPs and NGOs to come up with a more radical plan for reducing emissions, including halving the country's livestock population. WWF has previously called for a 40% cut in cow numbers in the Netherlands, saying the sector had outgrown its ability to safely dispose of its waste.
> —Levitt 2019 [2]

Across millennia of cohabitation since domestication, our relationship with dairy cattle has always been asymmetric, of course, involving exploitation and cruelty. Cattle, etymologically, is derived, via Anglo-French, from medieval Latin capitale – property, capital – it was our value and value in exchange. Yet it is also a co-constitutive and complex affair, of »significant otherness« as Donna Haraway would say,[3] full of interdependencies, entanglements, rituals, and more or less risky transfers of genes and microbial communities. I remember stories from my grandmother in rural Spain, in which cows and other farm animals were like family, providing not just sustenance but also passing their bodily warmth to the household in the cold winters. Worshipped in Hinduism as provider of the food of the Gods, a cow, if ill or living in unhygienic conditions, can be a vector of transmission of disease for humans, most notably zoonotic tuberculosis, via its raw milk.[4] The giant leap from familial care to a call for mass slaughter portrayed in the quotes above suggest that, obviously, a lot must have gone totally wrong in the relationship between humans and cows in the course of the 147 years separating the texts.

What will follow is a far from exhaustive account to think about how we stopped caring about our cows as companions and how to move forward. By diving into a series of short more-than-human vignettes, I aim to show how the nondescript landscapes of dairy farming encapsulate the brutal efforts of the modern technoscientific world to create new nature-culture »hybrids,«[5] their commodification and overproduction, and how these result in the rearrangement of multiple ecological networks, and of our position as humans within them. As a result, they are landscapes haunted by many traces of violences of modernity – what Elaine Gan, Anna Tsing, Heather Swanson, and Nils Bubandt call the »ghosts of the Anthropocene.«[6]

The setting of our exploration will be for the most part the Dutch countryside, where slightly more than million hectares of grassland and green corn forage for dairy cattle were literally built and engineered for their intensive use until exhaustion. More importantly for this story, it is also the place of origin of both the milking robot and of the Holstein-Frisian breed: the iconic white and black cows, and world's highest-production dairy animals. As such, those grasslands – for some a »magical empty center;«[7] for others a thoroughly organized landscape lacking all »mystery«[8] – are, I would argue, actually the setting of a horror story characterized by genetic engineering, artificial selection, forced pregnancy and surrogacy, robots, sensors, platforms, greed, and shit, lots of shit.

Blood and Milk

Van Tromp arrived in the womb of Texelaar at the port of Boston on November 6, 1861, thirty-six days after leaving North Holland. They belonged to a lineage of undoubted purity of blood, native of the Dutch municipalities of Beemster and Purmerend. All of that certified by multiple Dutch authorities. Together with three females and one male, this group of imported specimens, and its subsequent propagation in Belmont, Massachusetts, were part of a plan by Winthrop W. Chenery for the third and definitive attempt to introduce the Holstein cattle breed in the United States, previously hindered by »careless« crossbreeding and disease.[9]

Known for its high milk yield, the result of centuries of selective reproduction of the largest and more productive stock, the Holstein breed thrived in the wet grasslands of northeastern Holland out of a huge European demand for butter and cheese.[10] Once the Holstein went global, a breeding race began to increase their production and set new world records; from Segis Pietertje Prospect's 37,361 annual pounds of milk in 1919, to the 72,168 annual pounds of the cow named Ever-Green-View My 1326-ET in 2010, the yield of a Holstein has almost quadrupled since the times of Texelaar.[11]

Fueled by the industrialized production of dairy products after World War II, old breeding techniques have been replaced by artificial insemination technology as well as genetic and reproductive approaches, such as genetic evaluation, multiple ovulation, and embryo transfer to select animals that have high genetic potential. In the Netherlands, organizations like Veepro Holland facilitates the export of semen and embryos of Dutch cattle; companies like NIFA provides with all sort of services for artificial reproduction;[12] and others like CVR provide high- quality sperm and embryos »from high-tech cows and bulls.«[13] The latter includes in its offer listing of semen and embryos from top specimens, allowing farmers to choose the genetics of their future herd based on their productivity, feed efficiency, anatomical characteristics, or character. Somewhat not surprisingly, in 2015, researchers found that across almost all the Holstein bulls born out of artificial insemination worldwide, the number

Segis Pietertje Prospect Monument on the Carnation Milk Farm in Carnation, Washington. World Champion Holstein in milk and butter production. She was born in 1913 and died in 1925 Photo: Jimmy Emerson; https://www.flickr.com/photos/auvet/35342609622

of Y chromosome lineages – genetic diversity – had dramatically decreased: all of them are descendants of two ancestors born in 1880.[14]

Modern reproductive violence toward dairy cattle does not stop in artificial genetic selection. To meet planned outputs and make the most of each animal, cows need to be almost continuously pregnant and delivering calves. After receiving the first milk, or colostrum, the calf is separated from the cow so milk can be destined for human consumption. Eventually, six years after its birth, once the cow has »dried up,« and the value of its purebred blood and milk is exhausted, it is sent to the slaughterhouse to become LFTB, lean finely textured beef, also known as pink slime.[15]

Care, Outsourced

»Regular« cows do not have such pompous names as those of their »genetically superior« ancestors introduced above, but more and more are identified by numbers, printed in large, contrasting bold characters on their collars. These are not used just for easing the visual identification of the animals in ever-growing farms, but are wearables, transponders mounted with units packed with sensors that transfer performance calibrated data to automated milking systems. With 41 percent of the farms in the country using automated milking systems,[16] neckband-wearing cows are becoming an increasingly common sight in the green polder landscape.

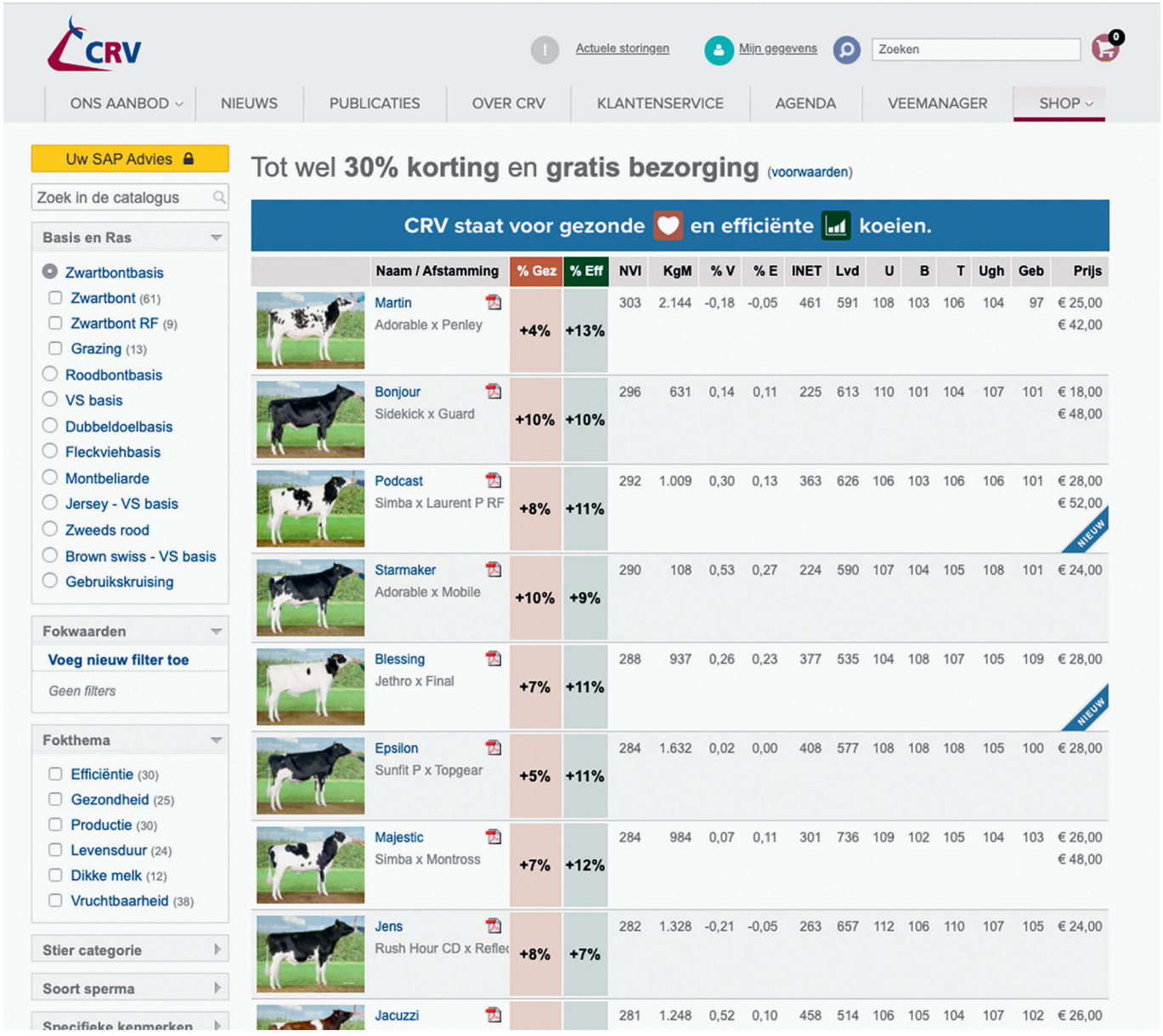
Since the invention of the milking robot in 1992 by the Dutch company Lely, automated solutions for dairy farming have multiplied. Self-guided barn cleaners, automated kitchen and feeding systems, feed pushers, automated brushes, robotic fencers, and cow traffic control tools, among other devices, form a machine ecosystem replacing human labor in dairy farms. At their center of the system is the collar. Its transponder geolocates each animal as it measures its activity, eating time, and rumination. It then passes the information to the robots so their algorithms can take appropriate action. For example, automated fences direct ill animals or those of lower social ranking to special zones, preventing the disruption of traffic of the most productive animals to the milking robot. Data from the collars and robots is accessible for the farmer in Time for Cows (T4C), Lely's digital farm management smartphone app.[17]

Ever-Green-View My 1326-ET, world record in milk yield 2010
Photo: Ever Green View/Beth Herges

Robotization limits »stressful« human-animal interactions, allegedly making the barn an »emancipatory« space for cows. Together with suggestions regarding the location of the milking robots, passageways, or automated fences, Lely advises farmers on issues such as the dimensions of and materials for the animals' lying areas, bedding, flooring, barn ventilation, and lighting. In the automated barn, cow's »Five Freedoms« – freedom from hunger, from discomfort, from pain, from stress, and to express their natural behavior – can be fulfilled. That is a contested claim, though, as behavioral research suggests that cows care for how they are being cared by us, humans. In those experiments, cows quickly learned to avoid a nasty human handler and approach the gentle one, with evidence of social learning as those cows observing the experiment approached the nice handler after seeing how it treated the test subjects. Interestingly, while behavior did change, milk yield did not differ when the gentle or aversive handler was present, supporting claims that automated milking per se does not increase production, but simply makes the process less labor-intensive.[18] One could say it is the farmers who gain the freedom from personally caring of the cows, now numbers on a screen: sensors, computers, and robots make work more flexible and lighter, while scaling up operations hiring fewer employees.[19]

The truth is that, despite the overall acceptance of the Five Freedoms since their released by UK Farm Welfare Council in the nineteen-sixties, researchers argue that they do not capture the breadth and depth of current knowledge of the biological processes that allow for understanding animal welfare and guiding its management.[20] They also assume that good animal welfare results if the negative effects the freedoms refer to are minimized, while in fact these are internally generated, motivating animals to behave in particular way. If the animal is hungry, searching and finding food by itself is a rewarding experience. That is, the ways animal welfare seems to be achieved through robotics is by making of the environment a »shock absorber …« – in Walter Benjamin's words – where technology and design are an anesthetic, a »… frozen smile barely hiding the terror it tries to cover.«[21] As a result, robotic milking spaces might be de facto reshaping animal behavior instead of offering opportunities for animals to engage in behaviors they find rewarding.

To make things more complicated, behavioral conditioning, the anesthetic, is also being built into the



Screenshot of CRV's available offer of reproductive cells for farmers
Source: CRV

60 and 82, cows in an automated farm in Overijssel, The Netherlands
Photo: Víctor Muñoz Sanz

flesh through genetic design. Artificial reproduction companies realized that some cows are more suitable for robotic milking than others, depending on the length and position of teats in the udder, or docility for conditioning. Thus, in order to breed a robot-suitable herd, physical and behavioral traits become parameters that facilitate farmers making choices when shopping bull sperm: on efficiency, the amount of milk produced in kilograms per total robot time in minutes, on the average time between two successive milkings, and on how quickly heifers get used to the robot: »Are you interested in bulls with the stamp ›robot suitable‹? Your livestock advisor can tell you all about it.«[22]

Shit Happens

Since 1984, milk production, and thus the population of Dutch dairy cows, had been restricted by European quotas. In the transition years toward their abolition in 2015, a steady growth in the number of cows followed, reaching 1.75 million in 2016 – a 23 percent increase since 2007. Farms also got bigger: since 2000, the number of cows in an average Dutch dairy farm has practically doubled, from 51 to 97. Naturally, more cows meant more manure: in 2016 Dutch cattle produced almost 6.5 million tons of excrement. That was practically 80 percent of the total manure coming from farm animals. As a result, ammonia and phosphate emissions from dairy farming have increased.[23]

In the nineties, fewer cows grazing and shitting outdoors, in combination with additional European environmental regulations, resulted in a reduction of ammonia emissions. The Nitrate directive (1991), the Habitat Directive (1992) and the National Emission Ceilings (2001; updated 2016) put a focus on this chemical, due to its impacts on terrestrial ecosystems and their biodiversity. In short, as soils become richer in nutrients, nitrogen-hungry, fast-growing plants displace other species and their companions; soils acidify and their chemical composition changes; in water bodies, eutrophication has toxic effects with similar consequences.[24]

The upward trend in the emissions of ammonia raised some alarms in The Netherlands. With just 15 percent of original biodiversity left – as compared to Europe (40 percent) or the world (70 percent) – the country has been consistently at the tail end of all biodiversity indexes.[25] In an effort to squaring the circle, the Dutch Nitrogen Action Programme was developed

Self-guided barn cleaner shoveling cow manure in a barn in Rotterdam, The Netherlands. Photo: Víctor Muñoz Sanz

in 2015 to reduce the amount of nitrogen in Natura 2000 areas, while maintaining economic development. In that framework, new nitrogen-emitting activities were being authorized on the basis on assumptions and models which »anticipated« their future effects. Eventually, such an ingenious attempt to balance competitiveness and ecology was nullified by the Dutch Council of State for breaching European law.[26]

Not surprisingly, the Council pointed directly at consequences for dairy farming in its ruling. In fact, ammonia emissions come mostly from intensive agriculture (48 percent), in particular from evaporation from cow manure.[27] As a result, permissions for new farms were halted, and further regulation on how and where grazing of livestock and fertilizing with manure could take place was advised. What's more, NGOs like Greenpeace and WWF, and political parties like D66 (social-liberals) or Groenlinks (greens) demanded a drastic measure: cutting the population of farm animals by half to protect nature, provoking the protests of hundreds of farmers.[28] All in all, the practicalities of how to tackle elimination of the »surplus« of 875,000 animal lives remained unclear, and any ethical implications unaddressed.

Toward a Synthetic Pastoral, or How to Live with our Monsters?

The relationship of the Dutch with their territory is known to be a complex and wicked one. As infrastructural works to protect its land from the rising seas were built, migratory patterns were disrupted and disappearing tides affected delta ecosystems. As dykes, ditches, canals, windmills, and pumps engineer a way to farm marshy lands, these same lowlands keep sinking and increasing in salinity. As native cattle was not productive enough, artificial selection and reproductive techniques generalized and genetically reshaped the stock. As its agricultural and farming production intensified, labor-saving technologies thrived while ecological systems found themselves under enormous pressure. As biodiversity declined, experiments to manage nature and steer it toward a wilder Anthropocene have followed by, for example, invoking the spirits of extinct feral cattle (*Bos primigenius*) to be manifested in the landscape, also by means of genetic cross-breeding[29]. With such an entrenched understanding of what nature is and how it should be kept, the expendability of hundreds of thousands of farm animals comes as no surprise. Instead of staying with

Automated dairy farm De Klaverhof, Moerdijk, The Netherlands
Photo: Víctor Muñoz Sanz

the trouble, the country seems to be in the midst of a highly anthropocentric battle against its own ghosts and monsters, paradoxically to attain and maintain the pictorial pastoralism of an idealized pre-anthropocentric ur-landscape.

Such a view is a paradigmatic example of the underlying conflict between ecologism and the defense of non-human animals, or anti-speciesism. Projects for ecosystem restoration come together with biological cleansing of other »harmful« species, clashing with the interests of the animals involved.[30] Besides for their chemical externalities, dairy cows are decried for being dependent, lacking in individuality, and being unable to live in the »wild.« Something I hope to have conveyed with this essay is how outrageous that position is: or, in Scott's words »How dare we, then, turn around and slander a species for some combination of normal herd behavior and precisely those characteristics we have selected for?«[31] The alternative, or living with the trouble we have created, requires a turn towards feminist inquiry and posthuman ethics in designing strategies for degrowth and cross-species coexistence, with lots of accountability and imagination to »help build ongoing stories rather than histories that end«[32] – make kin, not artificially conceived and commodified calves.

As Leo Marx explained, ordinarily, the word pastoral is taken as a synonym of an ideal scene of quiet rural life. In his view, such a focus on the term as a fixed idea of nature, landscape or ecology masks the fact that the pastoral is not a genre but a mode, a »particular way of being in the world.«[33] The key to this is its embodiment in the character of the shepherd, herdsman, farmer, or one of their many surrogate forms: a liminal figure at the intersection between nature and culture, that engages with the material, with the concrete here and now of human and nonhuman entanglements, with a preference for accommodation rather than imposition. As such, precisely placed at that complicated intersection, the new synthetic ecologies of artificially bred beasts, robots, and chemicals, call for the exploration of new stories of pastoralism in order to reimagine the relationships between society and nature beyond overproduction and domination.

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1 Winthrop W. Chenery: *Holstein Herd Book: Containing a Record of All Holstein Cattle in the United States, Also, a Sketch of the Holstein Race of Cattle*. Boston 1872.

2 Tom Levitt, »Animals Farmed: Deforestation and Meat, Dutch Cattle Wars and Wildlife Parks,« in: *The Guardian*, October 8, 2019, https://www.theguardian.com/environment/2019/oct/08/animals-farmed-deforestation-and-meat-dutch-cattle-wars-and-wildlife-parks.

3 Donna Haraway, »The Companion Species Manifesto,« in: *Manifestly Haraway*, 2016, p. 96.

4 Hannah Velten, *Milk: A Global History*. London 2010.

5 Bruno Latour, *We Have Never Been Modern*. Cambridge, MA 1993.

6 Anna Lowenhaupt Tsing et al.: *Arts of Living on a Damaged Planet*. Minneapolis 2017.

7 Adriaan Geuze, »Flatness,« in: *Mosaics West8*, ed. Fanny Smelik, Basel 2008, p. 6.

8 Dirk Sijmons, »You Can't Blame the Equipment,« in: *Artificial Arcadia*, ed. Bas Princen and Ed van Hinte. Rotterdam 2004, p. 108.

9 See note 1.

10 Jay L. Lush, J. C. Holbert, and O. S. Willham, »Genetic history of the Holstein-Friesian cattle in the United States,« in: *Journal of Heredity* 27, no. 2, February 1, 1936: pp. 61–72.

11 Gavin Ehringer, *Leaving the Wild: The Unnatural History of Dogs, Cats, Cows, and Horses*. New York and London 2019.

12 »NIFA Technologies,« 2020, https://www.nifa.nl/en/

13 »CRV – BETTER COWS > BETTER LIFE,« CRV, 2020, https://www.crv4all.nl/

14 Xiang-Peng Yue, Chad Dechow, and Wan-Sheng Liu, »A Limited Number of Y Chromosome Lineages Is Present in North American Holsteins,« in: *Journal of Dairy Science* 98, no. 4.

15 »Dairy Cows,« CIWF, 2012, https://www.ciwf.org.uk/farm-animals/cows/dairy-cows/.

16 Statistiek, Stichting KOM, 2020, http://www.stichtingkom.nl/index.php/stichting_kom/category/statistiek.

17 Víctor Muñoz Sanz, Marten Kuijpers, and Grace Abou Jaoudeh, »Agricultural Platforms,« in: *Harvard Design Magazine* 46, 2018, pp. 124–31.

18 L. Munksgaard et al: »Dairy Cows' Fear of People: Social Learning, Milk Yield and Behaviour at Milking,« in: *Applied Animal Behaviour Science* 73, no. 1, July 2, 2001: pp. 15–26; Heli Kiiman, Alo Tänavots, and Tanel Kaart, »The Yield and Quality of Milk on the Farms Using Twice a Day Conventional Milking in Comparison with the Farms Using Three Times a Day Conventional and Automatic Milking Systems,« in: *Agraarteadus* 24, no. 2, December 1, 2013: pp. 55–64; J. A. Jacobs and J. M. Siegford, »Invited Review: The Impact of Automatic Milking Systems on Dairy Cow Management, Behavior, Health, and Welfare,« in: *Journal of Dairy Science* 95, no. 5, May 1, 2012: pp. 2227–47.

19 Muñoz Sanz et al.: »Agricultural Platforms.«

20 David J. Mellor, »Updating Animal Welfare Thinking: Moving beyond the ›Five Freedoms‹ towards ›A Life Worth Living,‹« in: *Animals* 6, no. 3, March 2016: p. 21; John Webster, »Animal Welfare: Freedoms, Dominions and ›A Life Worth Living,‹« in: *Animals: An Open Access Journal from MDPI* 6 no. 6, May 24, 2016.

21 Beatriz Colomina and Mark Wigley, *Are We Human?: Notes on an Archaeology of Design*. Zurich 2016, p. 96.

22 »Met Fokkerij Naar Een Robotgeschikte Veestapel,« CRV, November 26, 2019, https://www.crv4all.nl/fokwaarden/met-fokkerij-naar-een-robotgeschikte-veestapel/.

23 Geert van der Peet et al., »Feiten en cijfers over de Nederlandse veehouderijsectoren 2018,« Wageningen: Wageningen Livestock Research, 2018; Agrimatie – informatie over de agrosector, 2020, https://www.agrimatie.nl/SectorResultaat.aspx?themaID=2272&indicatorID=2046&subpubID=2232&sectorID=2245.

24 Wallis De Vries and Roland Bobbink, »Nitrogen Deposition Impacts on Biodiversity in Terrestrial Ecosystems: Mechanisms and Perspectives for Restoration,« in: *Biological Conservation, Nitrogen Deposition Impacts and Biodiversity in Terrestrial Ecosystems: Mechanisms and Perspectives*, 212, August 1, 2017: pp. 387–89; »Ammonia Emissions from Agriculture Continue to Pose Problems for Europe,« in: *News, European Environment Agency*, October 12, 2019, https://www.eea.europa.eu/highlights/ammonia-emissions-from-agriculture-continue.

25 M.P. van Veen et al., »Halting Biodiversity Loss in the Netherlands: Evaluation of Progress,« Text, PBL Planbureau voor de Leefomgeving, March 19, 2009. https://www.pbl.nl/en/publications/Halting-biodiversity-loss-in-the-Netherlands; »Netherlands,« Biodiversity Information system for Europe, 2020, https://biodiversity.europa.eu/countries/netherlands.

26 »PAS mag niet als toestemmingsbasis voor activiteiten worden gebruikt,« Raad van State. https://www.raadvanstate.nl/actueel/nieuws/@115651/pas-mag/ (accessed May 6, 2020); »Nitrogen,« RIVM, 2019, https://www.rivm.nl/en/nitrogen.

27 »Manure Production by Livestock, 1986-2019 Compendium for the Living Environment,« CLO, https://www.clo.nl/indicatoren/nl0104-mestproductie-door-de-veestapel (accessed May 6, 2020); »Nitrogen and Phosphate in Animal Manure and Fertilizers, 1990-2019 Compendium for the Living Environment,« CLO, 2019, https://www.clo.nl/indicatoren/nl0106-stikstof-en-fosfaat-in-mest?ond=20880; »Questions and Answers on Nitrogen and Ammonia RIVM,« RIVM, 2020, https://www.rivm.nl/stikstof/vragen-en-antwoorden-over-stikstof-en-ammoniak#waar-komen-stikstofoxiden-of-ammoniak-vandaan-362951-more.

28 Wim De Vries, »Hoe Halveren We de Stikstofuitstoot in de Veehouderij? – ›Pak Vooral de Koeienstal Aan,‹« October 3, 2019, https://resource.wur.nl/nl/show/Hoe-halveren-we-de-stikstofuitstoot-in-de-veehouderij-Pak-vooral-de-koeienstal-aan.htm; Tjeerd de Groot, »Halveer de Veestapel - D66,« D66 – Voor de Toekomst (blog), September 9, 2019, https://d66.nl/halveer-veestapel/.

29 »Highlanders in the Lowlands: Re-Enactment of an Extinct Cow,« in: *Next Nature Network*, April 6, 2010, https://nextnature.net/2010/04/highlanders-in-the-lowlands; »Stichting Taurus – Experts in Begrazing.« http://stichting-taurus.nl/ (accessed May 6, 2020).

30 Caria Faria, »Muerte entre las flores,« in: *Más allá de lo humano*. ed. Antonio Giráldez López and Pablo Ibáñez Ferrera, Vigo 2018, pp. 96–107.

31 James Scott, »Four Domestications: Fire, Plants, Animals, and... Us,« in: *The Tanner Lectures on Human Values* delivered at Harvard University, 2011, p. 198.

32 Serenella Iovino, »Material Ecocriticism: Matter, Text, and Posthuman Ethics,« in: Timo Müller and Michael Sauter (ed.), *Literature, Ecology, Ethics: Recent Trends in Ecocriticism*. Heidelberg 2012, p. 66.

33 Leo Marx, »Does Pastoralism Have a Future?,« in: *Studies in the History of Art* 36, 1992: p. 211.