



## GOOD DIGESTION: The Metabolic Politics of Dutch Dairy Farming

ELSE VOGEL

University of Amsterdam

 <https://orcid.org/0000-0002-8319-0975>

A veterinarian once summarized dairy farming to me with the sentence: “A cow is a rumen [*een koe is een pens*], and a rumen is nothing else than a barrel that processes nutrients.” This *pars pro toto* pointedly indicates that on the dairy farm, everything is about digestion—productive digestion. These days, however, the side effects of such an “industrial metabolism” (Landecker 2013) are more and more apparent—not least in the Netherlands, the country with the highest density of humans and livestock living together in the world. While black-and-white dairy cows make for somewhat of a national symbol, the methane, ammonia, phosphate, and nitrate released through their digestive processes also mark them as major culprits of global warming and biodiversity loss. Ecologists have for years been warning that nitrogen-deposition levels specifically, the majority of which come from livestock production, are severely affecting plants and wildlife in the Netherlands. As a result, cows’ burps and farts no longer constitute an unremarkable side effect of rumen fermentation, but “a sign of a planet in trouble” (Govindrajan 2020, 198).

Concerns with bovine metabolism have of late become strikingly public. In 2019, the Netherlands’ Council of State, the country’s highest administrative court, judged the Dutch approach to curb nitrogen emissions as in conflict with

European directives for nature conservation.<sup>1</sup> As a result, permits for industrial expansion and infrastructural projects were withdrawn. The ruling propelled the country, where more than half of the surface is used for agriculture or horticulture, into the so-called nitrogen crisis, a set of legal, economic, ecological, social, and regulatory challenges posed by an excess of nitrogen. To bring emissions in line with EU legislation, large reforms in animal agriculture are on the political agenda, including drastically reducing the national herd and the forced buyout of farms in the vicinity of nature reserves. These plans, however, have faced major resistance from the farming community, increasing anti-government sentiment among these groups (Moses 2022).

Taking the nitrogen crisis as an exemplary case of contemporary debates over the environmental effects of industrial food production, in this article I introduce *metabolic politics* as a theoretical frame for understanding contested forms of governing biochemical flows and more-than-human eating and feeding relations. As Hannah Landecker (2019, 542) states, thinking with metabolism draws “empirical attention toward systems of interlinked processes rather than things.” Metabolic politics accentuates not just how the ways such interlinked processes are currently organized spread vulnerabilities unequally among us. In this article I argue that it also, as a more-than-human biopolitics (Asdal, Druglitrø, and Hinchliffe 2017), must engage the question of how metabolic relations are known, problematized, and intervened in. In my conceptualization, I draw on Michel Foucault’s (2003) formulation of biopower, which referred both to late modern practical techniques to use and tame bodies and their forces, capacities, and desires; and to ways of regulating life and its vicissitudes at the level of the human population. In this case, the bodies and populations in question not only cross species lines; it is the *relations* between species, and the material effects of such relations, that emerge as sites of control and care.

Where Foucault (2003) famously defined biopower through the maxim “to make live and let die,” I suggest metabolic politics revolves around the power to make and organize eating and feeding relations. This power does not simply lie with the state, capital, or humans; it is relational and multiple, crossing species and involving lively more-than-human activities. At stake is which relations and worlds are forged through eating and feeding—who eats and digests, who is eaten, who is left to stomach the waste, and what is transformed through eating. This politics plays out not only in parliament and public debate but also and importantly in the mundane yet technoscientific practices in which

more-than-human metabolic relations are established, regulated, and cared for—such as on dairy farms.

To focus my inquiry, I take as my case one of the first concrete interventions that followed the 2019 nitrogen ruling. In 2020, the government announced it would put legal limits on the protein content of cattle-feed concentrate in an attempt to curb the release of ammonia, a nitrogen compound, from livestock excretions. The so-called feed measure (*voermaatregel*) became highly controversial. I show how this seemingly small measure formed a “hot situation” (Stassart and Whatmore 2003; cf. Callon 1998) where diverse ways of understanding, regulating, and improving metabolic relations, and in particular cow digestion, clashed and opened up to contestation.

The feed measure was eventually retracted. Yet the controversy it sparked reveals key features of metabolic politics. Contestations and tensions arose over the forms of life that comprise the metabolic collective or polis; over ways of evaluating the health of organisms and ecosystems; and over forms of regulating the behavior of and relations between various eaters and feeders. I highlight how these clashes were sustained by the ac/counting practices through which various actors concerned with cattle metabolism enter in relation with cows and others implicated in their, and our, eating. Different knowledge practices enact various *versions* of metabolism, animated by different concerns and implying contrasting relations and courses of action—or what I call socio-material modes of ordering “good digestion.” Metabolic political tactics therefore often focused precisely on shaping how metabolic relations were sorted into discrete units of analysis and became legible for human intervention.

The aim of this article is not to advocate for one politics or mode of ordering digestion, or to suggest what a multispecies or metabolic justice (Chao, Bolender, and Kirksey 2022) would look like in this context. Rather, I hope my articulation of the key stakes and techniques of metabolic politics in this case serves to enliven the space of contestation over what constitutes good digestion in contemporary food systems by offering critical terms and questions that sensitize readers to some of the dilemmas and strategies involved in metabolic politics, in this case and others.

### **METABOLISM(S) AND MORE-THAN-HUMAN BIOPOLITICS**

By introducing metabolic politics, this article contributes to recent more-than-human reworkings of Foucauldian biopolitics (Asdal, Druglitrø, and

Hinchliffe 2017; Foucault 2003), with a particular focus on biopolitical tactics that cross species (Helmreich 2009; Paxson 2012). As has been described, the governance of reproduction and sex provokes concerns with purity, performance, and belonging (Svendsen 2021), while an immunological biopolitics, focused on biosecurity and haunted by threats of contagion, draws boundaries between inside and outside (Blanchette 2015; Porter 2019). By contrast, metabolic politics highlight entities' transformative relations with their environments in ways that defy bounded subjectivities, configuring bodies as having semi-permeable boundaries (Mol 2021, 2008; Solomon 2016). By outlining its key features, I show how engaging bodies in this way shapes how more-than human biopolitical collectives are assembled, health is valued, and governance strategies are elaborated.

As a nineteenth-century concept, metabolism moves between the biological and social realm; while industrial metaphors of the factory and labor deeply shaped biological renderings of metabolism (Landecker 2013; cf. Rabinbach 1992), biological theories on metabolism also figured as a metaphor in social theory, especially in Marxian understandings of industry-nature relations and the material flows of capitalist production (Clark and York 2005; Foster 1999; Swyngedouw 2006; Moore 2017). Concerned with capitalism's ecological ramifications and drawing on Marx' work, John Bellamy Foster (1999, 370) famously described capitalism as having caused a global "metabolic rift between human production and its natural conditions."

In this vein, and to underscore the extractive and violent nature of contemporary food systems, scholars have described the farm itself as having a metabolism. George Cusworth (2023, 58), for instance, argues that "food production operations are linked to the food system they operate within by those things that are brought onto (animal feed, labor, fertilizers, diesel, etc.) and leave (fruit, grain, greenhouse gas emissions, water pollution, etc.) the site in question. These material vectors are a vital part of their *metabolism*." Through engaging asymmetrical and intimate relations of eating and feeding, and by moving beyond the farm gate, Cusworth's proposal for a "metabolic ethics" importantly engages in political questions not just those whom we eat but also those who are implicated by our eating (cf. Mol 2021) and by what our food is eating (Landecker 2019).

Rather than theorizing farms, dairy farming, or the Netherlands as "a" metabolism, however, my articulation of metabolic politics concerns itself with how metabolic living emerges as an object of knowledge and governance, and with how the metabolic capacities of organisms and ecosystems are drawn into

economic production (Beldo 2017). Inflecting an eco-Marxist interest in metabolism with a Foucauldian attention to how life is administered and fostered (Foucault 1978, 138), I argue that a critical analysis of livestock farming's metabolic relations must include careful consideration of the conditions under which metabolic life becomes "a distinctive domain of practice and thought" (Lemke 2014, 14). Hence, while Cusworth's notion of metabolic ethics foregrounds the politico-ethical question of *whether* the metabolic effects of farming are accounted for, I suggest that it is equally politically salient to ask *which* "metabolic logics" (Vogel 2018) are mobilized and come to normatively shape ways of relating eaters, food, and their environments.<sup>2</sup>

Here, I take my cue from previous social science engagements with bovine metabolism that have focused on technoscientific practices concerned with the greenhouse gas methane, and thus on cattle's contribution to processes of global warming (Govindrajan 2020; Folkers and Opitz 2022; Turnbull and Oliver 2021; Hastrup, Brichet, and Nielsen 2022). For instance, Frida Hastrup, Nathalia Brichet, and Liza Rosenbaum Nielsen (2022, 5) write that sustainability discourses in animal agriculture often involve "sorting out potential symbiotic relations and identifying units to intervene in," thereby staging humans as the ones who fix, rather than cause, problems. Drawing on theorizations of symbiopolitics (Helmreich 2009) and microbiopolitics (Paxson 2008, 2012), Andreas Folkers and Sven Opitz (2022, 330) critically interrogate the "spatial imaginaries" of proposed dietary interventions on cattle and their rumen microbes to tackle climate change, analyzing these as biopolitical techniques of "symbiotic engineering" (see also Lorimer 2021).

In a blog essay likewise focusing on how cattle bodies become cast as sites of climatic governance, Jonathon Turnbull and Catherine Oliver (2021) introduce the notion of a more-than-human "metabo-politics," which they describe as "a form of governance concerned with interlocking corporeal and global flows." Emphasizing the political economic processes that bring bovine "life into the ambit of capital" (Turnbull and Barua 2022, 1), they warn against the false promise of a techno-fix in corporate greenwashing tactics. My articulation of metabolic politics resonates with their notion of metabo-politics but draws closer ethnographic attention to the various ways in which metabolic relations are known and problematized by the state and bureaucratic practices. I also highlight *clashes* over forms of metabolic governance and the role of agricultural and veterinary expertise in shaping such controversies. My analysis, moreover, is shaped by a sensitivity to materiality, relationality, and multiplicity characteristic of post-actor-network

theory or material semiotic approaches (Law 2008), resulting in a formulation of metabolic politics invested in showing the open-endedness and liveliness of practices, rather than in the identification of a dominant (capitalist or anthropocentric) ordering or discourse (Asdal, Druglitrø, and Hinchliffe 2017).

As concerns with the ecological aftermath (Landecker 2024) of industrial dairy production increasingly come to shape dairy farming's modus operandi, in my field I witnessed how this multiplicity spurred a politics around defining and intervening on the metabolic relations, capacities, and needs of organisms and ecosystems. In the narrative that follows, I highlight how this politics is embedded in the knowledge, standards, and practices relevant to the controversy of the nitrogen crisis, and to the feed measure in particular. After introducing my research and the Dutch nitrogen crisis in more detail, I first zoom in on the proposed governmental interventions in cows' digestive processes. I then contrast this version of good digestion with ethnographic narrations of how bovine digestion is problematized and cared for in dairy production, elaborating key features of metabolic politics.

### THE DUTCH NITROGEN CRISIS

With the aftermath of the World War II's famine still reverberating throughout the nation, Dutch agricultural policies in the 1950s embraced the motto *Nooit meer honger* (Never hungry again). Guided by a novel paradigm for agricultural progress, the government implemented income support and market measures to steer farmers toward becoming profit-seeking, risk-taking entrepreneurs and invested in the intensification, specialization, and mechanization of farming (Theunissen 2020). This model, which would later inform the Common Agricultural Policy of the European Union, made the Netherlands one of the largest exporters of agricultural products in the world today.

The nitrogen crisis casts the post–World War II agricultural revolution as a mistake, not an accomplishment. While industrial farming hinges on nitrogen as a key nutrient, current environmental concerns foreground that too much nitrogen harms the environment. Nitrogen oxides, ammonia, and nitrate acidify and overfertilize soils and waters, damaging plants and decreasing biodiversity. While construction machinery and traffic emit nitrogen oxides ( $\text{NO}_x$ ), dairy, pig, and poultry farms are the biggest sources of ammonia ( $\text{NH}_3$ ) from animal waste, making up more than half of nitrogen emissions.<sup>3</sup> To curb pollution, the European Union's wildlife and habitat legislation puts limits on nitrogen emissions around so-called Natura 2000 reserves. For these limits, this legislation relies on

European expert panels, on which Dutch scientists are well represented. Based on measurements of soil and plant growth across Europe, these panels have since the 2000s been defining and revising threshold values for eutrophication and acidification—so-called *critical loads* after which the amount of nitrogen becomes damaging to plants (Van Robben et al. 2012). In the Netherlands, Europe’s largest nitrogen producer, nitrogen deposition in these areas has been well above such defined critical loads for decades. Once a source of pride for its productivity and technological advancement, nitrogen-deposition data and legislation thus call attention to the environmental impact (*natuurdruk*) that comes with being a large food producer.

Many farmers feel, however, that their sector is unfairly represented and made to bear the brunt of environmental measures. While the nitrogen crisis was not as visible in the bigger cities of the Netherlands, it was inescapable as soon as one drove away from urban centers onto the highways connecting Dutch agricultural lands. In 2022, seemingly unending rows of blue-white-red striped protest flags—the Dutch national flag, but turned upside down—were planted on the edges of the meadows and crop fields that span more than two-thirds of Dutch land surface. Occasionally, protest signs complemented the flags, most commonly with the English slogan “No Farmers, No Food” and the hashtag “proud of our farmers” (*#trots op de boer*). In the past years, their tractors have blocked national highways, dumped manure on politician’s doorsteps, and occupied food-distribution centers. The actions stood out in a long history of European farmer protests against EU policies, subsidies, pricing, and environmental regulations, reflecting the complex relation between the agricultural sector and an ever-changing EU governance landscape (cf. Theunissen 2020).

Backed by a powerful agricultural lobby and widespread public and political support, the farmers’ resistance has made *stikstof* (nitrogen) not just into an everyday topic of conversation across the country but also a point of division. So much so that at the Dutch provincial elections of March 2023, the BoerBurger-Beweging (Farmer-Citizen-Movement, or BBB), a new populist political party launched to protest the proposed nitrogen policies, secured the largest vote, while a green-left alliance advocating in favor of a green agricultural transition and even stricter environmental measures followed suit.

In the theater of the Dutch nitrogen crisis, cows take center stage. Sometimes literally, such as when in 2022, a media-savvy farmer brought two of his cows—Klaartje and Betsie—to the parliament’s doorstep, asking the newly appointed minister of Nitrogen and Nature in front of dozens of journalists to

choose which one of them he should send to slaughter should he be forced to downsize his farm. (The cruel irony being that both of these cows, like all dairy cows, are bound to end up in the slaughterhouse eventually.) In this article, however, I move away from the spectacular politicization of cow digestion in the public sphere and focus on the practices through which various actors concerned with cattle metabolism attempt to optimize cows' digestive capacities.

To do so, I draw on ethnographic fieldwork conducted between 2020 and 2023. During the summers of 2020 (June–August) and 2021 (May–September), when COVID-19 lockdowns were lifted temporarily, I joined livestock veterinarians on their planned and unplanned visits to dairy farms. During these visits, vets and farmers conduct fertility checks, evaluate health and production, and perform regulatory tasks for the dairy industry and government. This participant observation gave me key insights into how health is problematized and responded to in the daily practices of cow husbandry. By studying industry and governmental policies and scientific publications on animal husbandry, and through following discussions in trade journals and on social media as the nitrogen crisis unfolded, I could further clarify and contextualize the knowledges, techniques, regulatory frameworks, and economic logics shaping both dairy farming and the proposed feed measure to combat nitrogen pollution. I have conducted (online and in-person) interviews with more than twenty-five livestock veterinarians. In addition, I spoke to more than twenty scientists, inspectors, and NGO representatives involved in the governance of livestock production. As a coffee break generally formed part of veterinary visits, I also came to meet many dairy farmers and their families and farmhands.

During all these fieldwork events, the nitrogen crisis invariably came up. Navigating this polarized political field proved challenging. Most farmers considered the political turmoil a threat to and attack on their livelihoods. An ethnographer was, to put it mildly, somewhat of a curiosity on farms, and often my introduction was met with a series of questions meant to determine whose “side” I was on. I specifically had to shake the suspicion I was an animal activist or nature fanatic that would expose them as animal abusers or polluters. Other informants saw the nitrogen crisis as a promising turning point toward more sustainable agriculture. All, however, seemed to agree it would fundamentally change the future of farming and human-bovine relations in the Netherlands. Sensitizing myself to such different positions through fieldwork allowed me to grasp the complex stakes and tactics of metabolic politics. They reveal themselves if we look at the specific practices through which nitrogen's metabolic relations become problematized and intervened on.

### CREATING NITROGEN SPACE: Cows on a Diet

Since 2019, a curious term has begun to occupy political and policy discussions: *stikstofruimte* (nitrogen space). Rather than depicting a physical space, this term indicates the margins within legislation for developing economic activities that add to nitrogen emissions. Much like the notion of the *carbon footprint* renders climate change into a matter of accounting (Lahn 2020), a focus on nitrogen space quickly framed the governance of nitrogen as a budgeting exercise, where all policies were evaluated in terms of how much nitrogen space they would create.

When the 2019 verdict came through that judged the Dutch approach to curbing emissions invalid, the Netherlands found itself in a legal deadlock. In an effort to decrease emissions quickly and create nitrogen space, the minister of agriculture announced immediate measures. The government changed the maximum speed on most highways from 120 to 100km/h and offered pig farmers voluntary buyout schemes. The third measure directly affected dairy farmers: it stipulated the reduction of the amount of protein in feed concentrates for cows; cows had to go on a diet.

The bulk of a dairy cow's diet in the Netherlands consists of farm-grown food such as grass or corn. This food is supplemented by concentrate feed supplied by livestock-feed manufacturers. The proposed governmental rule to limit protein content only amounted to the latter. In a press release and letter to parliament, the minister explained the rationale in simple input-output terms: "Generally, dairy cows in the Netherlands are fed more protein than the animal needs. The protein that is not digested by the animal will be released in the form of nitrogen. By reducing the protein content of feed, nitrogen emissions will be decreased."<sup>4</sup> The measure thus hinged on a stated imbalance between what cows eat and what they need.

While on average concentrate only makes up a quarter of the total ration in dry matter, the minister acknowledged its importance for farmers: in practice, feed concentrate "functions as the 'regulator' of the ration, used to substitute fodder and optimize the cow's nutrition."<sup>5</sup> It was thus important to ensure that the change in diet would not impact cows' health. An expert committee (Commissie Deskundigen Meststoffenwet, CDM) was asked to secure the scientific basis of the measure. In their report, and building on available data sets that track Dutch cows' diets, they proposed to make the permissible upper limit for protein content dependent on the farm's soil composition and productivity level.<sup>6</sup> These distinctions should account for a diversity of dietary needs in dairy

production: Farms on richer peat or clay soils tend to have access to protein-rich grass, but sand-based farms usually grow more starchy corn. For this land-bound ration, intensive farms (>20000 kg milk/ha) have to compensate by adding protein through concentrate. The more milk is produced per hectare land, the more farms rely on food imported from elsewhere.

By comparing the current food intake of dairy cows with these proposed limits, the committee could fairly easily calculate how much nitrogen emissions (in the form of ammonia) would be reduced by a lower protein content of feed. However, the committee's report acknowledged that not all farmers may conform to the rule, or that some would find ways of substituting the reduced protein in the concentrate through other means. To control for these possibilities, the committee adapted the estimated ammonia-emission reduction to account for 15 percent nonconformity and 5 percent substitution. With these adjustments, the measure still promised to yield a 0.23 kiloton reduction. This was more than the 0.2 kt ammonia reduction the ministry hoped to achieve. The extra 0.03 kt constituted an important safety margin that, the committee argued, controlled for any remaining uncertainties and adding confidence that the desired reduction would be achieved.

In the end, the committee ended up with a legally "hard" estimate of how much nitrogen space would be created through the feed measure. This was important. In their report of May 11, 2020, the CDM wrote: "The measure aims to *juridically, demonstrably, and verifiably* reduce the amount of nitrogen in manure of dairy cattle" (emphasis mine). Other ways to reduce ammonia emissions, such as letting cows graze outside more, or mixing manure with water, might have been equally or more beneficial for the environment, but they were not effective *legally*. They could not be accounted for in a time frame that would allow building projects to resume.

The minister emphasized, too, the practicality of the measure. Whereas roughage is variable, dependent on the soil, the crops, and the harvest of that year, feed concentrates' protein content is stable. It is already listed on the invoice of suppliers and thus easily accessed. From a governance perspective, this makes it controllable: inspectors would only need to request these invoices to check whether a farmer has acted in accordance with the law.

The announcement of the measure marked a new, more radical phase in the farmers' protests. Citing the Dutch law for the protection of animals, which stipulates that animals deserve proper food, hundreds of farmers went to the police to press charges on the minister for alleged animal-abuse offenses. Agrarian

organizations declared “war” on the government and pulled out of ongoing conversations to reduce emissions.

On July 9, 2020, the minister responded in a letter to parliament, restating that the measure included a subclause that allowed farmers to be exempted from the rule if they could demonstrate that the protein content of the total ration for their cows was below a certain threshold. The minister also stated that she was consulting veterinarians on the issue. The Dutch Royal Society for Veterinary Medicine swiftly conducted a survey among its members: 70 percent of bovine vets indeed expected the measure would have “serious consequences for the health and well-being of dairy cattle.”<sup>7</sup> In particular, the press release of the professional organization stated that the measure may make it impossible for vets and farmers to regulate the health of individual cows through rations. The result, vets predicted, would be less resilient and fertile cows, and the poorer health of calves.

In the end, it was the instability of statistical knowledge itself that undid the feed measure. In the summer of 2020, it became clear that the initial calculations to prove the effectiveness of the feed measure could not hold up in court. The predictions of the average protein content of silage had used 2018 as a reference year, but researchers had calculated that the situation in 2018 was no longer applicable to that of 2020. Due to a recent period of drought, farmers were faced with a shortage of good pasture grass. So as not to harm the health of cows, this shortage must be compensated with a higher protein content in concentrates. No legal nitrogen space would thus be created through the measure. Somewhat ironically, then, climate change interfered with the plan to reduce nitrogen levels.

The feed measure constituted a form of managing metabolic relations that relies on accounting logics and the techno-legal tools of the state. As it made headlines for weeks in all major Dutch newspapers, it drew previously relatively unproblematic metabolic relations between cows, wildlife, farmers, and citizens into stark public relief. How did, despite precautions and subclauses, this seemingly rational and rather mundane measure evoke such a strong response? To answer this question, I turn to the dairy farm, where cows’ digestive capacities are ordered in strikingly different ways.

## GOOD DIGESTION ON THE DAIRY FARM

### *“Untapped Potential”*

On a sunny day in August 2021, I joined the veterinarian Caroline on a visit to Johan’s family farm. After a walk around the stables, inspecting both the

dairy cows and youngstock, and checking up on a sick cow, we met Johan in his kitchen for a cup of coffee. After some chitchat on the weather, Caroline turned to the dairy-milk control data. Based on samples from individual cows, the dairy factory sends the farmer regular detailed overviews of milk production, and the amount of fat, protein, urea, and white blood cells in the milk. These numbers give crucial insight into the health of the cows, and Caroline has carefully studied them prior to her visit. She concluded that although there are no major health problems, there is an issue with bad retainment, meaning an inefficient digestion. In her words: “There is untapped potential in your cows. You are now feeding your manure tank,” indicating that although Johan is spending a lot on food, he does not get a return on investment. It all leaves the cows “at the back end,” because the rumen microbes are not able to process it.

Johan’s cows are black-and-white Holstein-Friesians, the predominant dairy cattle breed in the Netherlands.<sup>8</sup> These cows have an astonishing daily milk production averaging thirty liters, while some surpass this amount by twofold. Next to careful breeding, dairy cows’ bio-intensification is the result of sophisticated feeding and management regimes (Overstreet 2018). To underscore this need for care, people in the industry often refer to Holstein-Friesians as “metabolic athletes” (LeBlanc et al., 2006, 1272) or “top-sport cows” (Verkaaik 2022). The central node of the elaborate network of cow nutritional care is the rumen and its complex community of microorganisms. The rumen only remains healthy if proteins and starch remain in balance in the cows’ food supply.

Caroline indicated that she thought Johan could increase production if he added more protein to the feed ration. But how? She suggested brewer’s grain, a waste product from beer brewing. But that is expensive and needs to be bought from the food trader. Johan rather wanted to adapt the ration with the existing grass silage from his land. But due to drought, the quality of the fermented grass had been really bad all year. Together they looked at the analysis made of a sample of the grass’s latest cut. The numbers indeed indicated that the silage had very low protein content. They decided that adding soy flakes might be the way to go, as long as Johan added enough roughage—grass, corn, or beets often produced on the farm itself. When Caroline noticed my somewhat puzzled look, she explained: “Soy flakes contain a lot of rumen-undegradable protein, but you also have protein sources that the rumen can degrade to intestinal digestible protein. You kind of want the latter, because that is not only cheaper, but that way, the bacteria *do the work for you*. They process the food to microbial protein that the cow can then use to produce milk.”

Here, the veterinary's description of the cow with which I started this article—a cow is a rumen—comes to life in practice. Dairy farming relies on activating the metabolic activity of rumen microbes to produce value. Farmers and their advisors, however, cannot directly observe the rumen.<sup>9</sup> They make use of various signs and proxies to value digestion and get to know microbes. The dairy milk controls, for instance, allow Caroline to check the balance between milk protein and nitrogen urea. This balance tells her something about microbial activity in the rumen and specifically their protein conversion. The liver makes urea from unused ammonia in the rumen. High urea levels thus indicate an inefficient digestion, while a low level indicates a lack of (rumen-degradable) protein in the diet. Such evaluations are aided by industry-wide norms, for instance, that urea levels should be between 20–30 mg/100 g milk. Samples from the silage and other parts of the ration allow farmers to detail the nutritional content of their cows' diets with remarkable accuracy.

Optimizing digestion does not just involve attending to the contents of food and milk. Committed farmers and their vets will also walk around in the stable. Farmers told me that a well-metabolizing cow ruminates often and chews at least sixty times per belch. At a training event for farmers, a presenting veterinarian reminded his audience that the best stable invites cows to lie down, as one hour of extra lying per day can mean an increase in milk production of up to two liters. In its ideal form, then, the entire socio-material organization and epistemic infrastructure on a dairy farm promotes the digestive capacities of rumen microbes.

### *Metabolic Vulnerability*

As bovine digestion is pushed to ever greater intensification, it also becomes increasingly vulnerable. One of the first things I learned during fieldwork was to pay close attention to manure. On my first day on a dairy farm, I joined the veterinarian Gerard and the farmer Hans for their round in the stable. Gerard, with his long veterinary glove and portable ultrasound scanner, checked on the fertility of a number of cows. Almost without exception, the cows we got close to started defecating, and many released long bouts of gas after Gerard's arm left their rectum. Unfazed by these sounds and smells, my company concentrates on registering which cows were pregnant, in heat, or suffered from an infected uterus.

The round also provided a good occasion to check on other health aspects of the cows. Gerard pointed out some white foam lying around the feed, coming

from the cows' mouths. He then mentioned that the manure of a particular cow was rather runny. The farmer, surprised, looked around. "Hmm, yeah . . . ." Curious, I asked: What is *good* manure? Gerard explained it must be dry enough to stay on the slatted floor, but liquid enough to slip through if it falls on the cracks between them. The vet took out some dung from a cow's rectum and moved it between his fingers. A grassy substance remained: inefficient digestion.

The runny manure and the foam confirmed what, based on the dairy-milk controls, Johan had already suspected: Hans's cows suffered from rumen acidosis. This is a key concern on farms as it leads to health problems and a decline in production. Johan and Hans discussed the summer—which had been hot and hard on the cows. The vet proposed to adjust the cows' diet, explaining to me that rumen acidosis is associated with an excess of carbs and sugar in the ration. But the farmer mentioned that he was already talking to the feed advisor to adjust the ration, so they decided to wait a few weeks and see whether this would have any effect.

Conditions change constantly, and climate, grazing, and weather affect the quality of food and the condition of cows. Optimizing digestion is not only complicated by seasonal flows and dietary changes but also by the fluctuations of the gestation cycle. During biweekly or monthly visits, veterinarians' fertility checks were often accompanied by appraisals of the fat reserves of a cow through the visual inspection of markers such as the visibility of the ribs and the prominence of the backbone. This informs so-called body condition scores (BCS), where a BCS of 1 is a severely emaciated cow, a 5 indicates a cow that is too fat, while a score of 3 signifies an optimal condition. Noting them down in the farm's digital management system allows vets and farmers to capture fluctuations of cow metabolism and health over time, and to adjust the ration accordingly.

In particular, farmers will aim at an optimal BCS at the start of cows' "dry period" (the time before the next calving where the cow is not milked). This prepares her for the later stages of pregnancy and especially the immediate postnatal period, during which she rapidly starts producing milk again. During this period, a cow will often produce more milk than her eating can support and must draw on her fat reserves. If she has too much fat reserve to draw on, however, her liver will have trouble metabolizing the quick release of fat into the blood stream, a process that can make her vulnerable to pathologies. Common health problems on the farm—milk fever, ketosis, laminitis, hepatic steatosis, displaced abomasum, and calf diarrhea—all stem from metabolic misalignments.

Despite an elaborate knowledge infrastructure, then, dairy farmers never get a full grasp on metabolic processes. Their work toward achieving good

digestion is never finished and fundamentally uncertain. As disturbances might express themselves months later, questions often remain: Was it the ration, the heat in the summer, the stress of a switch to a different milking system, or her genes? For farmers, the challenge, and the fun, lies in anticipating, using, and supporting volatile bodily processes that can be cultivated but never fully controlled. On regular Dutch dairy farms, then, achieving good digestion involves operating on the razor's edge of maximizing production while managing its associated health risks.



Figure 1. A cow in her dry period with farm silage in the background.

Photo by Else Vogel.

## METABOLIC POLITICS

Contrasting the ways in which the feed measure problematized metabolic processes with how cow digestion is worked with and cared for on dairy farms reveals different modes of knowing, valuing, and engaging with microbial and bovine digestion. In the next sections, I articulate three key features of metabolic politics as they play out in this case.

### *Configuring the Metabolic Polis*

My case involves different problematizations of metabolic relations: While the nitrogen crisis, and the feed measure in particular, foregrounded a concern with metabolic excretions, pollution, and excess, on dairy farms it is the synthetic, productive qualities of metabolism that take center stage. These different ways of approaching cow digestion both enact concern for more-than-human

metabolic collectives. These collectives, however, are composed differently. Metabolic-political tactics, then, assemble communities of eaters, and this assembling puts boundaries on who or what can eat, feed, digest, and waste, and with which effects. What gets enacted as the unit or scale through which metabolic input or output is analyzed—a country, a farm, a cow, or a nature reserve—itsself emerges as important in shaping how such relations are constituted and evaluated.

Focusing on the national territory, the EU's legislation and the nitrogen-deposition data draw equivalences between the excretions of cows and emissions from cars, airplanes, and machinery. They enact the Netherlands as a crowded land in which these various industrial digesters share and compete for limited space. The critical deposition loads (Van Robben et al. 2012) legally solidified the right of protection of the metabolic needs of the plants and animals living in Dutch nature reserves. Interestingly, the scientific data and models defining vulnerability to nitrogen pollution focus only on vegetation types deemed "characteristic" of a habitat type and "plant community" (Van Robben et al. 2012, 17). Environmental policies thus also include selections of which life belongs where and needs to be taken into consideration. As a result of ecologists' administrative efforts, these life forms, although food for neither cows nor humans, emerge as deeply implicated in their eating and become part of the political community. But where wildlife is staged as a precious, vulnerable life worth cherishing, Dutch cows are enacted as polluters who literally and administratively take up nitrogen space. While the feed measure did include some consideration for their welfare, in the nitrogen crisis's overall metabolic-political frame, they emerge as deeply problematic nature-culture hybrids (Anneberg, Vaarst, and Bubandt 2013)—echoing the Indian "natural farmers" in Daniel Münster's (2017, 26) ethnography, who considered Holstein cows as "outside the boundaries of the cow species and even outside nature itself." Statistics showing the large contribution of agriculture to national nitrogen emissions cast farmers, too, as wasteful citizens claiming scarce public resources.

On the dairy farm, by contrast, it is bovine and microbial life that is of central concern. Its business model banks on the surplus value that emerges through their vital metabolic capacities. Here, the cow is enacted as a fragile but valuable contributor to the common good of food production. Moreover, dairy production also involves the recognition of relative conditions of edibility: Cows and consumers of dairy products alike make use of rumen microbes' unique ability to digest cellulose. The notion that food is not food for everyone, and that there

are crucial differences between eaters, thus constitute the fabric of this metabolic collective.

Metabolic politics also revolves around the power to obscure or erase needs, or to exclude eaters from consideration if they do not belong. For instance, the Dutch government did not always act as nature's advocate. In the years preceding the nitrogen crisis, several efforts were made to solve the problem by lobbying to remove the EU's administrative designation of areas as protected nature, thus prohibiting its flora and fauna from placing demands on the metabolic collective. The newly appointed far-right government's coalition agreement in 2024 promises to once again lobby for an exception to EU environmental policy, although experts doubt this will succeed.

On dairy farms, competing eaters also emerge at the margins of the polis: parasites are eradicated, as are calves, although they first need to be born for their mothers to keep producing milk. Importantly, both modes of organizing digestion do not incorporate accountability relations to the eating and feeding relations outside of the Netherlands, such as those affected by the soy or palm oil plantations that provide the feed concentrate in question.

A first salient metabolic political tactic emerging from my field, then, concerns the kinds and categories of metabolic life that are administered and fostered (Foucault 1978, 138). How populations are included or excluded in optimization efforts determines which lively beings enter the polis, how distinctions emerge between eaters—human or nonhuman, characteristic or not, natural or in excess—and how different life forms are brought into relation with each other, as eater or food, as polluter or threatened.

### *Defining Dietary Needs and Metabolic Vulnerability*

Second, at stake in the controversy over the feed measure were different ways of knowing, categorizing, and valuing normal, optimal, or bad digestion. In the Netherlands, what dairy cows eat, produce, and excrete is meticulously recorded. Both the Dutch government and farmers and veterinarians make use of this elaborate epistemic infrastructure. But they do so in different ways, shaping different metabolic politics.

For the government tasked with creating nitrogen space, the available data on farms, soil, feed, and animals opened bovine digestion up for intervention on a national scale. The expert panel providing the scientific basis of the feed measure drew on statistical averages of milk and silage contents to assess the nutritional requirements of the national herd and compare this to the current

average protein intake of cows. This resulted in an apparent gap between dietary need and consumption. What characterized the government's mode of ordering bovine digestion, then, is its reliance on principles of economic bookkeeping. As scholars have described, from the minimum living wage of the nineteenth century to the weight loss strategy of calorie counting, such economic accounting logics—that what goes in must come out—have proved central to knowledge of and interventions on (human) metabolism (Landecker 2013; Mol 2013; Vogel 2018; Yates-Doerr 2012). Similarly, here, the goal is to keep checks and balances in order through a restricted budget.

Nutritional practices on farms, by contrast, orient knowledge toward the volatile needs of *individual* cows as they emerge on their farms. Where statistical averages serve government in controlling for and eliminating variations, thus allowing for generalizable and legally effective conclusions, the food-and-milk-contents data used on farms enact nutritional needs as *changing* over gestational, seasonal, and reproductive cycles. Moreover, seeing, feeling, and sometimes smelling manure, and appraising cow bodies and behavior also form a crucial part of knowing digestion on the farm.

The establishment of needs on dairy farms is, moreover, deeply entangled with the demand of production. Knowledge serves to both establish and anticipate the metabolic capacities of particular cows—high-yielding cows are described in breeding magazines as having “a strong will to milk”—and to identify “untapped potential,” so these capacities can be optimized. As such, knowledge on digestion signals metabolic vulnerability as well as opportunity. With the feed measure, the government deprived farmers of a crucial way of responding to both. The general norm imposed by the minister was at odds with the very game that constitutes dairy farming: customizing and fine-tuning a diet for a particular cow and herd. So much so that it posed, in the vets' words, “serious consequences for health,” or, in the farmers' words, even animal abuse.

That the ministry consulted the veterinary profession on the feed measure shows how, as in other forms of multispecies coexistence, veterinary expertise mediates metabolic relations (Broz, Arregui, and O'Mahony 2021). The professional organization's depiction of dietary needs, however, did not go unchallenged even within the veterinary sector. Yet others destabilized the very metabolic script underlying the “cow form” of modern agriculture. A vet who is no longer a practitioner but a consultant in the sector, stated in an interview: “Like in professional sports, if there is no top-level support, the whole system collapses. The argument that if we take protein out of the food the animals will

suffer—this is bullshit, Holsteins are just bred to produce way too much milk. The ones with really high milk yield, they all have foot and udder problems. They are very sensitive for all kinds of systemic, production-related diseases. This is where the health problems lie, not in a little bit less protein.” Echoing this position, in an op-ed in a prominent newspaper, a retired vet asked the rhetorical question: “Now who is really abusing our dairy cows here?”<sup>10</sup>

In this framing, then, it is not the proposed measure that poses health risks—cows’ metabolic vulnerability rather emerges as the “capitalist indigestions” (Overstreet 2018) of agriculture itself. The alternative version of good digestion conjured aligns with the practices of a minority of Dutch farmers who work with less productive cattle breeds, often of Dutch heritage (Verkaaik 2022). In contrast with the U.S.-imported Holsteins, breeders value these cows for their “robustness,” a category of metabolic health that indicates an animal’s resilience to environmental fluctuations.

A key aspect of the metabolic politics at play in this case, then, is the question of what constitute dietary needs, as well as metabolic health and vulnerability, and how these should best be appraised. From the critical loads for nitrogen deposition to the minimum defined protein content of feed, and from urea levels in milk to BCS, my analysis highlights how metabolic politics involve forms of enumeration that make distinctions between what is relevant or valuable and what is not, thereby performing some realities as changeable while taking others for granted. Yet in the controversy, although some expertise (i.e., that of veterinarians) was staged as more authoritative than others, these knowledges were also contested. Political tactics thus involve forms of digestive and “nutritional black-boxing” (Yates-Doerr 2012), but also, crucially, the “un-boxing” of metabolic relations, destabilizing the terms of comparison underpinning proposed interventions into bovine digestion.

### *Aligning Eaters*

Third, the controversy does not just reveal different notions of what comprises good digestion but also highlights different modes of doing and styles of governance. These include different ways of engaging actors toward achieving such goods, and ways of handling deviations from the norm.

On the dairy farm, metabolic productivity is possible thanks to generations of selective breeding that has allowed farmers to “grow” ever more efficient digesters. This industrial bovine metabolism is fragile. Enacting good digestion on the dairy farm is a matter of constantly attending, adapting, and tinkering (Mol,

Moser, and Pols 2010) with what is practically available. Farmers and vets grapple with lively bodies and materials, such as a food offer dependent on weather and finances. Although highly advanced and technological, it is also a craft requiring sensorial attunement. Crucially, it does not just depend on the actions of farmers and vets. The farmer is highly dependent on cows, rumen microbes, and their metabolic labor (Beldo 2017; Barua 2019). As the veterinarian Caroline put it, after all; “Ideally, microbes do the work for you.”

Aligning eaters, however, is not an easy task. If a cow does not feel good, she will stop eating or produce less milk—while microbes will simply die. But while a farmer can and will send an uncollaborative cow to slaughter, cows and rumen microbes cannot be *forced* to eat. They can, however, be nudged, invited, tricked, or disciplined into eating, for instance by Total Mixed Rations, a method of feeding that involves cutting different foods together so finely that it becomes difficult for cows to select some over others.

In the nitrogen crisis, a different set of techniques for managing actors emerged. Interestingly, the government seemed reluctant for the state to take on a role in reducing nitrogen emissions. It was only when animal activists took the government to court that EU regulations became binding and the state was enacted as an arbiter in regulating the metabolic material flows of its territory. The government then approached metabolic relations as, or in as far as they are, under its control. Rather than cultivating a responsiveness to the lively actors that comprise dairy farming, the feed measure was designed to be as little dependent on their conduct as possible while producing maximum effect. The metabolic fluctuations and uncertainties on farms were dealt with by reducing the measure to the easily accessible feed concentrate. Possible non-conformities with the rules were handled through the threat of inspections and fines, but also by adding safety margins in the legal accounting of the measure, and allowing for exceptions. Nitrogen accounting, as other sustainability policies, conjures the world “into an up-for-grabs inventory of controllable units” (Hastrup, Brichet, and Nielsen 2022, 12). The state thus emerges much like an operator on a switchboard, engaging both cows and farmers as mere levers to pull in the nitrogen cycle.

In the feed measure, moreover, intervening in microbial flora is portrayed as an intervention on a much larger scale. The feed measure betrays a similar ambition of “symbiotic engineering” as Folkers and Opitz (2022) identify in efforts to reduce methane emissions. Rather than connecting the microbiological and planetary scale, the ecological, economic, and legal realms of nitrogen situate

cows and their rumen microbes within metabolic relations with local soil, waters, livelihoods, and ecosystems. Still, the goal is to intervene in a system of interlinked processes by making few but key adjustments. Targeting the microbial flora of the rumen promised to circumvent or postpone politically sensitive discussions about the sustainability of human consumption of dairy products and the future of the Dutch food system, including the dreaded possibility of having to cut the size of the national herd. But what seemed like a techno-fix turned out to touch on the core of dairy farming. The protests that erupted revealed the elements as far more unruly than hoped for.

Hence metabolic political tactics may include putting limits on who can feed, eat, digest, and excrete, and penalizing or eliminating those who divert from such limits. But contrasting the state's failing approach with the more successful governance of life on dairy farms suggests that a more felicitous tactic may consist of creating conditions for growing, cultivating, and training eaters, enrolling them as good nutritional subjects by working on palatability and taste (cf. [Overstreet 2018](#)).

## CONCLUSION

The nitrogen crisis forms a key moment in Dutch agricultural history, where the nation's metabolic ambitions and more-than-human socialities are profoundly reconfigured. In this article I explored the first concrete problematization of and interventions in bovine metabolism that followed the 2019 court ruling. The case highlights that different ways of knowing, valuing, and intervening in more-than-human eating and feeding relation—in this case, between cows, humans, microbes, wildlife, and technology—enact differing normative ideals of society and nature. The challenges revolved not around convincing stakeholders of the value of sustainable farming, but around how to socio-materially embed and embody different forms of “good digestion” in practice. While a technical matter closed the feed-measure controversy, how to calibrate “individual and collective relations of agreement” between foods and eaters ([Mol 2021](#), 118) in the nitrogen crisis remains disputed.

Metabolic politics adds to recent scholarship on multispecies eating and feeding relations, which details the various nonhuman eaters, such as animals, plants, and microbes, with whom people are “entangled in a messy meal” ([Haraway 2008](#); [Abrahamsson and Bertoni 2014](#); [Bertoni 2013](#); [Mol 2021](#); [Paxson 2023](#)). These entanglements offer no cozy conviviality: Since “there is no way to eat and not to kill,” the dilemmas of more-than-human living offer “no way to

pretend innocence and transcendence or a final peace” (Haraway 2008, 295). Yet the specificities of how metabolic collectives are shaped and organized do matter.

Like other more-than-human biopolitical projects (Asdal, Druglitrø, and Hinchliffe 2017), metabolic politics thus involves troublesome and situated valuations of who/what deserves protection and what is expendable for the greater good. In this article, I have made these valuations explicit by contrasting different modes of organizing metabolic relations, extending to distinct political communities, ways of valuing health, and governance techniques. This article, then, equips the reader not with a normative yardstick to “evaluate how the enactment of agricultural care can be done” (Cusworth 2023, 66), but with critical terms and questions to analyze how such conundrums are handled and played out already—thus learning to become affected by the irreconcilable dilemmas and lively normativities that animate metabolic politics.

While I have described metabolic politics in the case of an agricultural sector deeply entangled with technocratic, multilevel governance apparatuses, this article provides a frame for tracing how the ecological conditions of possibility and effects of food systems are problematized in other bureaucratic, social, and geographical contexts. It would be interesting to see how metabolic politics play out in contexts without elaborate regulatory frameworks, where industrial food production is not the norm, and where scientific and professional expertise play more marginal roles in shaping configurations of metabolic communities, health, and governance.

The analytical scope of metabolic politics, finally, also extends to forms of more-than-human metabolic living outside the world of food production. In the “age of flatulence” that is the Anthropocene (Govindrajan 2020), the resource extraction and pollution from other industries or urban infrastructures increasingly come into public focus, leading to contestations over how to govern their ecologies (cf. Barua 2023). While the metabolic political tactics in these cases will differ, it remains vital to ask which metabolic relations are foregrounded, how and whose metabolic vulnerability is accounted for, and when metabolizing is framed as nourishing or destructive, and for whom.

## ABSTRACT

*In the Netherlands, what dairy cows eat, produce, and excrete is meticulously recorded and controlled. While farmers optimize cows' diets for production, the side effects of this industrial metabolism have recently become problematized in new and strikingly*

public ways. Since 2019, the country has faced a so-called nitrogen crisis, a set of ecological, legal, and political challenges posed by nitrogen pollution from industrial activities, predominantly livestock farming. This article offers the concept of metabolic politics as a theoretical lens for understanding contestations over the power to organize more-than-human eating and feeding relations. Drawing on ethnographic fieldwork with veterinarians and farmers, I contrast governmental interventions in cows' digestive processes with how bovine digestion is cared for on dairy farms. This reveals key features of metabolic politics: struggles over the forms of life that comprise the metabolic polis; clashing ways of valuing the health of organisms and ecosystems; and diverging styles of governing metabolic collectives. [biopolitics; metabolism; dairy farming; nitrogen; veterinary medicine; the Netherlands]

### SAMENVATTING

In Nederland wordt nauwgezet bijgehouden en gecontroleerd wat melkkoeien eten, produceren en uitscheiden. Waar boeren het rantsoen van koeien optimaliseren voor productie, krijgen de neveneffecten van dit 'industriële metabolisme' steeds meer publieke aandacht. Sinds 2019 staat het land namelijk voor een 'stikstofcrisis', een reeks ecologische, juridische en politieke uitdagingen die grotendeels voortvloeit uit stikstofuitstoot door de veehouderij. Dit artikel introduceert het concept metabole politiek om inzicht te geven in de machtsdynamieken die spelen bij het organiseren van eet- en voedingsrelaties tussen mens, dier en natuur. Op basis van etnografisch veldwerk met dierenartsen en boeren vergelijk ik overheidsinterventies in de spijsverteringsprocessen van koeien met de manier waarop op melkveebedrijven gewerkt wordt aan 'goed verteren'. Dit illustreert belangrijke kenmerken van metabole politiek: strijd over welke levensvormen deel uitmaken van de metabole polis; botsende manieren om de gezondheid van organismen en ecosystemen te waarderen; en uiteenlopende benaderingen van het besturen van stofwisselende gemeenschappen. [biopolitiek; metabolisme; melkveehouderij; stikstof; diergeneeskunde; Nederland]

### NOTES

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1. The existing approach, the Programma Aanpak Stikstof, or PAS, allowed farmers to expand if they simultaneously implemented measures that promised to reduce emissions in the future.
2. Studies in feminist STS and anthropology on metabolic science and human nutritional practices have also shown that significant historical shifts have occurred within the science of metabolism (Landecker 2013; Levin 2014), and there are various contrasting scientific or medical accounts of what (good) metabolism is and how it should be intervened on (Yates-Doerr 2012; Vogel 2018).
3. Website of the Environmental Data Compendium of the Netherlands, <https://www.clo.nl/indicatoren/nl0189-stikstofdepositie> (last accessed March 27, 2024).
4. Government of the Netherlands website, <https://www.rijksoverheid.nl/actueel/nieuws/2020/05/06/tijdelijke-regeling-krachtvoer-voor-melkvee-in-kader-van-stikstofaanpak> (last accessed March 27, 2024). Translation mine.
5. The letter of parliament, published on the open website: <https://open.overheid.nl/documenten/ronl-02f8d4bf-c630-49c4-8a6a-5854b28e5421/pdf>
6. My translation from the website of the Government of the Netherlands, <https://www.rijksoverheid.nl/documenten/rapporten/2020/08/10/cdm-advies-'vermindering-ammoniakemissies-door-minder-eiwit-in-krachtvoer-van-melkvee'> (last accessed March 27, 2024).
7. My translation from the Royal Dutch Veterinary Organization website, <https://www.knmvd.nl/stikstofregels-veehouderij-mogen-niet-ten-koste-gaan-van-diergezondheid-en-welzijn/> (last accessed August 28, 2023).
8. For histories of the emergence of these high-yielding cows, see Theunissen 2020 and Orland 2003.
9. Radhika Govindrajana (2020) notes that for scientists, too, the rumen is “hard to know” and has a somewhat mysterious quality.
10. <https://www.volkskrant.nl/columns-opinie/opinie-wie-mishandelt-hier-eigenlijk-onze-melkkoeien~bda95ff2/> (last accessed August 28, 2023).

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