Ecological Biopower, Environmental Violence Against Animals, and the "Greening" of the Factory Farm

Jonathan L. Clark

Abstract

The promulgation of pollution control regulations governing factory farms has led to a striking new way of representing and intervening in the bodies of farmed animals: the body is being represented as a source of pollution, and various technological interventions, from genetic engineering to dietary changes, are being deployed to reduce pollution at the source. In this article I analyze this new technoscientific project through the theoretical lens of ecological biopower. Focusing on the industrial pork sector's efforts to keep the cost of complying with nutrient management regulations in check, the article examines the case of "environmental nutrition," a dietary strategy that aims to reduce the excretion of nutrients from the bodies of swine. By highlighting whose diet is being changed in this approach and whose is not, I argue that environmental nutrition is as much about avoiding the exercise of ecological biopower over human beings as it is about exercising ecological biopower over farmed animals. I also argue that the pressing need to reduce the environmental impacts of factory farming is being used to justify new forms of violence against animals.

Keywords: ecological biopower, Foucault and animals, factory farming, environmental violence against animals

Since 1944, the National Research Council (NRC), one of the most influential non-governmental scientific advisory bodies in the United States, has been publishing Nutrient Requirements of Swine (NRC 2012). Given its title, one might expect that the main purpose of this handbook is to explain how best to meet the animals' nutrient needs. Yet as Richard Lewontin and Jean-Pierre Berlan (1986, p. 28) once wrote, we must be careful not to confuse "the 'needs' of animals" with "the needs of capital." A more accurate title would actually be Nutrient Requirements of the Pork Industry, for the main purpose of the handbook—and, indeed, of the field of swine nutrition as a whole, at least as it has tended to be practiced in the United States to date—is to help the industry formulate diets that maximize profits, whether by trimming the feed bill or, as I explain in this article, by helping to keep the cost of complying with environmental regulations in check.

Published in 1998, the tenth edition of the handbook included a new chapter titled "Minimizing Nutrient Excretion" (NRC 1998, p. 103). According to leading swine nutritionist Gary Cromwell (2005), who chaired the subcommittee that wrote this edition, the industry had traditionally given little thought to this topic. By the early 1990s, however, a groundswell of public concern about the water pollution caused by factory farms had led to the promulgation of nutrient management regulations governing the disposal of excess manure, and the cost of complying with these regulations had created an economic incentive to reduce excretion of nitrogen and phosphorus, the two most commonly regulated nutrients.

Over the past two decades, animal scientists in the United States and elsewhere have developed numerous strategies for reducing nutrient excretion, including phase-feeding, split-sex feeding, selecting animals for increased productive efficiency, and using metabolic modifiers to increase efficiency (CAST 2002; 1996; Kornegay 1996; Kornegay and Harper 1997; NRC 2012, pp. 194-202; 1998, pp. 103-106). Scientists at the University of Guelph, in Ontario, Canada, even went so far as to create genetically engineered Enviropigs™ who are able to excrete low-phosphorus manure. Swine nutritionists have developed several dietary strategies, including an approach that E.T. Kornegay and A.F. Harper called "[e]nvironmental nutrition," or "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, p. 100; cf. Longenecker and Spears 1995, p. ii). Taken together, these efforts are part of a larger development in animal technoscience, in which the bodies of farmed animals are being targeted for environmental improvement (Twine 2010, pp. 135-143), a development that is being driven partly by regulatory pressure.

In technoscience, Paul Rabinow (1999, p. 408) explained, "[r]epresenting and intervening" go hand-in-hand; the goal is not simply to know an object, but to know it "in such a way that it can be changed." In the field of swine nutrition, as in the other animal sciences, it is the bodies of farmed animals that are subjected to this technoscientific gaze (Derrida 2008, p. 25; Twine 2010, pp. 83-94). The point is not simply to know the body, but also to alter it, often in ways that are designed to maximize profits. The promulgation of pollution control regulations governing factory farms has led to a striking new way of representing and intervening in the bodies of farmed animals: the body is being represented as a source of pollution, and various technological interventions, from genetic engineering to dietary changes, are being deployed to reduce pollution at the source.

I examine this new technoscientific project through the lens of Michel Foucault's (1990, pp. 135-159) concept of biopower. According to Rabinow and Nikolas Rose, biopower "entails one or more truth discourses about the 'vital' character of living human beings; an array of authorities considered competent to speak that truth; strategies for intervention upon collective existence in the name of life and health; and modes of subjectification, in which individuals work on themselves in the name of individual or collective life or health" (Rabinow and Rose 2006, p. 195, italics omitted; see also Lemke 2011, pp. 117-123). As this influential elucidation of the concept suggests, biopower has typically been used to analyze the exercise of power over human life. Over the past decade, however, scholars in the fields of environmental studies and animal studies have sought to expand Foucault's concept by suggesting that biopower is exercised over "all life," not just human life (Wadiwel 2002, para. 3, italics in original), and that it is often exercised in the name of the environment (P. Rutherford 1999). Combining these two insights, several scholars have argued that certain regimes of environmental governance—including, most notably, endangered species preservation and wildlife management—subject nonhuman animals to "ecological biopower" (Youatt 2008, p. 404; see also Bergman 2005; 1990, p. 82; Chrulew 2011; Dutkiewicz 2010; Luke 2000; Rinfret 2009; S. Rutherford 2011, pp. 84-86, 118, 132-133, 138, 193).

It is certainly true that environmental governance has led to new ways of representing and intervening in the lives of nonhuman animals, at both the individual and the population scales. And it is also true that this is being done in the name of discourses that seek to protect the ecological conditions of life for human beings and other species (Youatt 2008). This means that the first three prongs of Rabinow and Rose's framework are easily met. It is the fourth prong—modes of subjectification—that should give us pause. After all, there is no evidence to suggest that nonhuman animals work on themselves in the name of the environment (Bergman 2005; Youatt 2008). The case of environmental nutrition provides an interesting angle on this issue. By focusing on whose diet is being changed and whose is not, I argue that environmental nutrition is as much about avoiding the exercise of ecological biopower over human beings as it is about subjecting farmed animals to ecological biopower. This does not, however, mean that we should eschew the concept when thinking about environmental interventions into the lives of nonhuman animals. To the contrary, as I demonstrate below, a great strength of biopower as a concept is that it helps broaden our understanding of violence against animals, including violence that is done in the name of the environment.

Before jumping into the argument, let me offer a few comments about the empirical focus of the article. Although my analysis focuses on the United States, efforts to reduce nutrient excretion are also underway in other countries where manure disposal is being regulated, including Canada and the Netherlands. And although I focus on swine production, other livestock and poultry sectors have also responded to regulatory pressure by seeking to reduce nutrient excretion. Finally, although I focus on nutrients, a similar story could be told about other potential pollutants that are either already being regulated or for which regulation is looming on the political horizon. A good example is the work that is currently being done to reduce methane emissions from cows and other ruminants.

Environmental nutrition

Manure is a valuable fertilizer because of the nutrients it contains, particularly nitrogen and phosphorus. As a result of the industrialization of swine production, however, many swine breeding and feeding operations in the United States have such high densities of animals to farmland that they generate excess manure (Key et al. 2011). Excess phosphorus is the biggest challenge facing the industry. The manure produced by many operations contains more phosphorus than is needed as fertilizer by all the farmland on the operation. Various efforts are underway to tap the value of excess manure, including the construction of methane digesters that promise to use it as a source of energy to power the facilities in which the animals are confined (Key and Sneeringer 2011). For many operations, however, the least costly way of dealing with excess manure, given existing technologies and markets, is to apply as much of it as possible to nearby farmland, whether on site or at another farm in the immediate area, even if this means applying it at a rate that supplies more nutrients than the land needs.

Though an expedient solution to the industry's manure management problem, using farmland as a low-cost sink for the disposal of excess manure has led to serious environmental problems, including the contamination of groundwater and the pollution of lakes, estuaries, and other surface waters. Nutrient runoff is a major concern. Applying excess manure causes nutrients to accumulate in the soil. Storm-induced runoff can transport these nutrients into surface waters, accelerating the process of eutrophication and leading to fish kills and other problems. In the early 1990s, in response to concerns about nutrient runoff, Pennsylvania and other states in the U.S. began promulgating nutrient management regulations restricting (but not banning) the use of farmland as a waste sink, and the federal government has since followed suit. By setting a maximum legally acceptable nutrient application rate, nutrient management regulations limit the amount of excess manure that an operation may apply on site. Any that may not be must be managed in some other, typically more expensive way, such as hauling it to a farm that needs the nutrients. Lowering the nutrient content of a given volume of manure increases the amount of it that may be applied per acre before exceeding the maximum legally acceptable nutrient application rate. Nutrient management regulations thus create an economic incentive to reduce excretion of nitrogen and phosphorus. And because phosphorus presents the more formidable regulatory challenge (for reasons I cannot explore here), there is an added incentive to reduce excretion of it.

Phosphorus is not just a valuable fertilizer and a potential pollutant. It is also an essential nutrient that plays numerous anatomical and physiological roles in the bodies of swine. As in all vertebrates, it is a key component of the skeleton. If the diet contains too little, bones can weaken and begin to break. Young pigs can develop rickets, older pigs can develop osteomalacia, and sows producing large amounts of milk can develop paralysis of the hind legs (Cromwell 2005; NRC 2012, p. 78).

The NRC handbook defines not how much phosphorus the animals need (whatever that might mean), but the minimum amount needed to maximize growth rate and feed conversion efficiency, two important production traits (Cromwell 2005; NRC 2012, p. 74). This amount differs depending upon how an animal is used (NRC 2012, pp. 208-209). For example, young pigs who are kept as part of the breeding stock are said to require more phosphorus than do feeder pigs, who are slaughtered when they are approximately six months old (NRC 2012, pp. 208-209). Because the life of a feeder pig is so short, Penn State's Environmental Standards of Production for Larger Pork Producers in Pennsylvania explains, the industry need not concern itself with "long-term skeletal strength" (Mikesell and Kephart 1999, p. 9).

If, on the other hand, the diet contains more phosphorus than the animal can utilize, the excess is excreted into the urine and feces,[2] where it becomes a potential regulatory problem for the industry. One of the most straightforward ways of reducing phosphorus excretion is to feed the animals no more of this nutrient than is needed to achieve production goals. Traditionally, the industry added extra phosphorus as a safety factor. "Little attention was paid to 'over-supplementing' diets with nutrients," Cromwell (2005, p. 611) explained, "as long as it was not overly expensive." "The rationale was that the nutrients in excess of the animal's requirements were simply stored in the body tissues or excreted in the manure" (Cromwell 2005, p. 611). But this all changed with the promulgation of nutrient management regulations, which, as Cromwell (2005, p. 611) explained, created "a strong incentive in the swine industry to reduce [phosphorus] excretion."

The pork industry has long been aware that it is possible to maximize production without maximizing bone strength (Kornegay and Harper 1997). This is a clear example of why it is so important to distinguish the industry's needs from the needs of the animals. The industry's need to keep compliance costs in check has increased the economic incentive to skimp on skeletal strength, particularly in the case of feeder pigs. Yet as Kornegay and Harper (1997) suggested, this strategy has the potential to undermine animal welfare:

> It is well known that the amount of [phosphorus] required to maximize growth is less than the amount required to maximize bone integrity. Perhaps, from the perspective of animal well-being, attempts to maximize bone integrity are most important. But from an environmental perspective, attempts to maximize bone integrity results [sic] in excessive excretion of [phosphorus]. (Kornegay and Harper 1997, p. 104, citations omitted).

As regulatory pressure increased manure disposal costs, they predicted, the industry would eliminate the safety factor and begin feeding the animals no more phosphorus than needed to maximize production; in fact, the industry might ratchet down the phosphorus level even lower by feeding for optimum rather than maximum production. In either case, they explained, the animals would receive less phosphorus than needed to maximize bone strength (Kornegay and

[2] On a factory farm, swine manure is a liquid slurry that consists of feces, urine, water, and anything else that falls through the slatted floors of a confinement facility.

Harper 1997). The implications of this strategy are striking: to keep regulatory compliance costs in check, the industry would be growing animals with deliberately weakened skeletons, perhaps even so weak that animal welfare would be compromised.

The industry quickly realized that, even with feeder pigs, it is possible to skimp too much on skeletal strength, though the problem shows up only after the animals are killed. "Although maximizing bone development is not necessary for the production of a market pig," Kornegay and Harper (1997, p. 104) wrote, "a more difficult question is how much bone development is required to prevent damage to the carcass during mechanical processing that occurs during slaughter." Bones that are too fragile can break in the slaughterhouse, damaging the carcass and cutting into profits. One study of environmental nutrition found that reducing the safety factor had weakened vertebrae, which fractured when slaughterhouse workers stunned the animals just before killing them (Dritz et al. 2000). These fractures caused "blood spotting on the loin muscle," the authors wrote, "which had to be trimmed for cosmetic purposes," reducing the value of the carcass (Dritz et al. 2000, p. 121).[3] "When formulating dietary phosphorus concentrations," they advised the industry, "the balance between environmental concerns and improving product quality must be weighed" (Dritz et al. 2000, p. 124). In other words, the challenge is to pinpoint the profitable degree of skeletal strength, taking into consideration carcass quality, feed costs, regulatory compliance costs, and other relevant economic factors. It is difficult to imagine what any of this might have to do with the animals' needs.

It is important to acknowledge that skimping on skeletal strength is nothing new. It goes back at least as far as the New Leicester sheep. Created by famed nineteenth-century British breeder Robert Bakewell, these sheep were designed to be all meat and no bone. "By careful selective breeding," Karl Marx wrote, Bakewell had "reduced the bone structure of his sheep to the minimum necessary for their existence," which enabled them to reach slaughter weight faster than other breeds (Marx 1992, p. 315; see also Ritvo 1987, pp. 66-67, 77). Moreover, skimping on skeletal strength is but one example of the kind of ruthlessly efficient cost-cutting that characterizes the subsumption of farmed animals under capital (Benton 1993:152-161). But

[3] The pork sector is not the only one that has faced this problem. According to a 2003 article in the *Chesapeake Bay Journal*, efforts to reduce phosphorus excretion from broiler chickens can increase "the risk of broken bones in the birds, which could result in bone chips in the meat, a major concern of the poultry industry." http://www.bayjournal.com/article.cfm?article=1200 (accessed on July 25, 2012).

although cost-cutting is nothing new, the kinds of costs that must be kept in check are constantly changing. Only in the past several decades have the livestock and poultry sectors had to confront the cost of complying with environmental regulations. What is new, then, is that skimping on skeletal strength has become a strategy for keeping regulatory compliance costs in check. Insofar as the industry is actually implementing this strategy—and Cromwell (2005) implied that by 2005 the U.S. pork sector had already begun to do so—it is producing regulatory friendly skeletons, friendly precisely because they have been deliberately weakened.

Ecological Biopower

The emergence of the regulatory friendly skeleton demonstrates that the promulgation of pollution control regulations governing factory farms has led to new ways of representing and intervening in the bodies of farmed animals. Yet in Rabinow and Rose's (2006) view, biopower entails more than just biological technoscience; it also involves modes of subjectification. In the case of environmental governance, this means the making of "environmental subjects—people who have come to think and act in new ways in relation to the environmental domain being governed . . ." (Agrawal 2005, p. 7, italics omitted; see also Darier 1996). This presents a problem when applied to farmed animals. As far as we know, farmed animals whose diets have been altered, or whose bodies have been refashioned, to make them more "environmentally friendly" are not thereby made to work on themselves in the name of the environment. Instead of aiming to create "shifts in the subjectivities of those undergoing regulation" (Agrawal 2005, p. 17), the animal scientists whose work I describe in this article have sought to create shifts in the anatomy and physiology of farmed animals. They have sought to create environmental bodies, not environmental subjects. Of course, farmed animals become who they are partly as a result of the particular technological assemblages in which they find themselves entangled (Holloway 2007). As a consequence, targeting the bodies of farmed animals for environmental improvement may lead indirectly to changes in who—not just what—they are. Moreover, as in other areas of environmental management (Rinfret 2009), some strategies that aim to make farmed animals more environmentally friendly do involve deliberate efforts to change how they behave. Efforts to convince cows to keep out of streams come to mind. Even in such cases, however, it is by no means clear that the animals become self-regulating environmental subjects. In any case, this does not appear to be what is happening in the case of environmental nutrition.

Lewis Holloway and Carol Morris (2007, p. 95) have acknowledged that the modes of subjectification prong of Rabinow and Rose's framework "is a stumbling block to the acceptance of biopower, as Rabinow and Rose define it, in relation to human interventions in the lives of livestock animals." In a creative effort to overcome this conceptual obstacle, they offer what they describe as "a more relational conception of biopower in which [humans] work on nonhuman others alongside their work on themselves . . ." (Holloway and Morris 2007, p. 96; see also Holloway et al. 2009; Morris and Holloway 2009; Srinivasan, in press; Twine 2010, pp. 86-87, 89). Building on Holloway and Morris's work, Krithika Srinivasan suggests that the ultimate targets of a technoscientific intervention—in my case, farmed animals—need not become self-regulating subjects in order for that intervention to be regarded as an exercise of biopower; it can be the agent who deploys the intervention, rather than the target, who becomes a new kind of subject (Srinivasan, in press). Morris and Holloway (2009) offer an example of what Srinivasan has in mind. They suggest that livestock breeders "might be understood as needing to be persuaded to work on themselves (and ultimately their animals' bodies) through their enrolment into the truth discourses about genetic approaches to livestock breeding" (Morris and Holloway 2009, p. 327). Applying this logic to the case of environmental nutrition, one might hypothesize that nutritionists and farmers have become environmental subjects who work on the diets and bodies of farmed animals in the name of the environment. Although this is a potentially fruitful avenue of research, I want to offer a different take on the modes of subjectification issue, one that focuses on whose diet is being managed and whose is not.

By 2050, global consumption of animal products is projected to explode, particularly in the so-called developing world (FAO 2011, p. 79). In light of these projections, the question of how best to mitigate the environmental impacts of the world's seemingly insatiable appetite for meat, milk, and eggs is being debated with a renewed sense of urgency (see, e.g., Pelletier and Tyedmers 2010; Steinfeld and Gerber 2010). Technological fixes such as environmental nutrition should be distinguished from what food historian Warren Belasco calls "anthropological fix[es]," in which "we redesign people's values, not their gizmos, to meet the challenges of feeding the future" (Belasco 2008, p. 118, footnote omitted). In today's debate, all sorts of anthropological fixes are being advocated, including veganism, vegetarianism, and a contraction and convergence strategy that acknowledges the unequal "ecological hoofprint" that divides the rich from the poor (Weis 2010). In the latter strategy, the wealthy would reduce their consumption of animal products so that the poor could increase theirs, and the world would eventually converge on an ecologically sustainable per-capita level of consumption (McMichael et al. 2007).

Though acknowledging that technology alone cannot solve the problem, and that curbing consumption will be necessary, Henning Steinfeld and Pierre Gerber (2010), lead authors of Livestock's Long Shadow, the Food and Agriculture Organization of the United Nations' (FAO's) influential report on the environmental consequences of livestock production (Steinfeld et al. 2006), have stressed the difficulty of engaging in dietary biopolitics. One of the problems, they write, is that "[p]olicies directly targeting dietary patterns are often resented as interfering with very personal choices of how and what to eat . . ." (Steinfeld and Gerber 2010, p. 18238). Indeed, it is far easier to change the diets—or even the bodies—of farmed animals than it is to challenge the association of meat with modernity, or to convince the world's wealthiest consumers to give up their dietary privileges. After all, farmed animals who are asked to switch to a more environmentally friendly diet don't complain about affronts to their consumer sovereignty (cf. Emel and Hawkins 2010).

Diet is a biopolitical project. Whether by encouraging the consumption of animal products or by calling on consumers to go veg, various institutions and movements attempt to shape dietary choices (Twine 2010, p. 166). Vegetarianism and veganism can be understood as modes of subjectification; people become self-regulating subjects who work on their own diets and bodies, often in the name of animal rights, the environment, or both (Tanke 2007; Taylor 2010; Thiermann 2011). In my view, what is significant about technological fixes like environmental nutrition is that they lessen the need for policymakers to attempt to create these kinds of environmental subjects. These fixes work on the diets and bodies of farmed animals so that consumers need not work on themselves. Although it is important to be critical of green consumerism and the neoliberal subjectivity it tends to inculcate (Szasz 2007), we should be just as critical of technological fixes that promise to relieve consumers of the burden of changing who they are (cf. Warkentin 2006). These sorts of fixes are a good example of what Donna Haraway (2008, p. 268, footnote omitted), drawing on the work of Sarah Franklin (2003), has called "designer ethics, which aim to bypass cultural struggle with just-in-time, 'high technology' breakthroughs" (see also Twine 2010, p. 142). Examined from this perspective, environmental nutrition is but the latest in a long line of "cornucopian technological fixes" that lessen the need for policymakers to exercise ecological biopower over human beings (Belasco 2004, p. 121).

Environmental violence against animals

Practices like skimping on skeletal strength should be understood as forms of violence against animals. They are clear examples of what Derrida (2004, p. 73) described as the "purely instrumental, industrial, chemico-genetic treatment of living beings." In light of Foucault's (2000, p. 340) distinction between power relations (which seek to control conduct) and relations of violence (which target the body), one might be tempted to wall off discussions of violence from discussions of biopower (for discussions of the violence/power distinction in the context of human-animal relations, see Palmer 2001; Thierman 2010). But as Foucault (2000, p. 341) himself explained, violence is often wielded as an "instrumen[t] of power."

The exercise of biopower over animals often entails violence, but this violence is inflicted in the name of life (Srinivasan, in press). In some cases (e.g., the neutering of stray dogs), the violence is said to benefit the animals on whom it is inflicted (Srinivasan, in press). In other cases (e.g., the killing of so-called invasive species), violence is inflicted on one group of animals to benefit another (van Dooren 2011). As Srinivasan explains, it is the justification for the violence—that it aims to foster life—that makes it part of the exercise of biopower (Srinivasan, in press).

In her call for greater dialogue between the fields of environmental sociology and animal studies, Amy Fitzgerald (2007) highlighted the need for more research on the various ways in which animals are harmed in the name of the environment. Scholars in the field of animal studies have analyzed violence against animals (Derrida 2008, p. 25; 2004), and political ecologists have taken up the topic of environmental violence (Peluso and Watts 2001), but to date there has been relatively little work on environmental violence against animals. Much of the existing work has focused on killing in the name of the environment, as in efforts to eradicate invasive species (van Dooren 2011). But what the concept of ecological biopower suggests is that, in addition to the power to kill, environmental violence against animals also involves the power to make live (Chrulew 2011). We see this in captive breeding programs, in which "forced reproduction" is used to attempt to save endangered species (Haraway 2008:291; see also Bergman 1990, p. 82; Chrulew 2011; Freeman 2009; Stein 2004; Whatmore and Thorne 1998). And we also see it, I argue, in the targeting of animal bodies for environmental improvement.

By its very nature, factory farming is about making live. As Cary Wolfe (2010:22-23) puts it, "the practices of maximizing life, of 'making live,' in Foucault's words, through eugenics, artificial insemination and selective breeding, pharmaceutical enhancement, inoculation, and the like—all for the purposes of maximizing the efficient production of flesh—are on display in the modern factory farm as perhaps nowhere else in biopolitical history." Through a ruthless efficiency that seeks to reduce life to the biological bare minimum that is necessary to maximize profits, factory farming entails the production of animals whose bodies are "maintained in a bare, weak state" (Wadiwel 2002, para. 13). The deliberately weakened skeleton embodies this violent logic in a quite literal way.

If taken too far, skimping on skeletal strength clearly has the potential to undermine animal welfare. Unfortunately, however, I found no studies examining what effect, if any, environmental nutrition has had on the welfare of farmed animals. It would thus be premature to conclude that animal welfare is being sacrificed to keep compliance costs in check. But even if environmental nutrition were found to have no impact whatsoever on animal welfare, it would still constitute a troubling example of environmental violence against animals. This is because such practices only intensify what Dinesh Wadiwel has described as the "shrewd and calculating management of life" that has long been brought to bear on the bodies of factory farmed animals (Wadiwel 2002, para. 9). And what is perhaps most troubling of all about these practices is that an even shrewder, more calculating, and more ruthless efficiency is being celebrated as "eco-efficiency," greenwashing the underlying violence.

Conclusion

Since its inception, factory farming has been an industry in which environmental destruction and violence against animals have been closely intertwined (Boggs 2011). Now certain efforts to address the industry's environmental problems are intensifying violence against farmed animals (Noske 1994). And with influential organizations like the FAO accepting the spread of factory farming as inevitable, this troubling trend seems poised to continue. "As it stands," the FAO (2011, pp. 94-95) recently wrote, "there are no technically or economically viable alternatives to intensive production for providing the bulk of the livestock food supply for growing cities." In light of this reality, they argued, the challenge is "to make intensive production more environmentally benign" (FAO 2011, p. 95). In other words, we need to green the factory farm. In pursuit of this goal, animal scientists are transforming the bodies of farmed animals into even more efficient biological machines for converting feedstuffs into flesh. Some call it "responsible intensification" (Steinfeld and Gerber 2010, p. 18238). Others see it as "a recipe for animal suffering, dressed up as a 'green' solution . . ." (Compassion in World Farming 2009, p. 31).

Despite the industry's green rhetoric, there are serious questions about whether strategies such as "environmental nutrition" will actually lessen the environmental impacts of factory farming. But although it is crucial to evaluate the alleged greening of the factory farm on its environmental merits, in this article I have sought to move beyond a purely environmental analysis. After all, these strategies are not simply technological fixes, to be evaluated solely on the basis of whether they are likely to solve the environmental problems they purport to solve. They are also technoscientific interventions into the bodies of farmed animals, and the violent nature of these interventions should be part of the public debate about how best to solve the environmental problems caused by the spread of factory farming.

"If what is at stake is the fate of the planet," Neil Evernden (1999, p. 149) once wrote, "then any intervention seems justified." There is a growing danger that the pressing need to address the mounting ecological crisis will be used to justify a tightening of the grip of ecological biopower on the bodies of vulnerable humans and nonhumans alike (cf. Smith 2011, p. 126). According to Matthew Chrulew's (2011) chilling account, this is exactly what we see happening already with the captive breeding of endangered species. As he writes, "[t]he closer a species to extinction—when a wild population is most endangered, or a captive one most fragmented, when the category of 'species' holds the most importance and thus the visibility of living organisms within the whole ensemble is most obscured—the stronger then is the grip in which the bodies of the last remaining individual animals are held" (Chrulew 2011, pp. 148-149, footnote omitted). A similar tightening of ecological biopower's grip is occurring down on the factory farm. In the face of the seemingly unstoppable expansion of factory farming, the need to keep the environmental impacts in check is being used to justify ever more intensive interventions into the bodies of farmed animals.

We must remain perpetually "wary of environmental justifications" for these sorts of technoscientific interventions into vulnerable bodies (Stein 2004, p. 221). And the concept of ecological biopower can help us do just that. One of the great strengths of this concept is its ability to lift "the halo of the conservation imperative," revealing the violence that is often inflicted in the name of the environment (Chrulew 2011:147 n.3). Helping to lift this halo is a worthwhile project for scholars who are trying to build bridges between the fields of environmental studies and animal studies.

Bio

Jonathan L. Clark, J.D., Ph.D. is an assistant professor of sociology at Ursinus College. His teaching and research focus on animal studies, environmental studies, and the intersections between these two fields. Contact information: Department of Anthropology & Sociology, Ursinus College, 601 E. Main St., Collegeville, PA 19426. E-mail contact - jclark@ursinus.edu

Acknowledgements

I would like to thank the three anonymous reviewers for helping me think through certain key elements of my argument, particularly the potential effects of environmental technoscience on the subjectivity of farmed animals and the relationship between ecological biopower and environmental violence.

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