

## **Food Fight! Davis vs. Regan on the ethics of eating beef**

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**Uncorrected author's proof**

### **Introduction**

One of the starting assumptions of the debate over the ethical status of animals is that someone who is committed to reducing animal suffering should not eat meat. Peter Singer, Tom Regan and other philosophers associated with the so-called animal rights movement—which is probably better referred to as the animal protection movement, given that not all of its adherents employ a theory of rights—have advocated vegetarianism and veganism as the dietary embodiments of their philosophies.<sup>i</sup> On the other side of the debate, philosophers who have challenged animal protection often argue that animals occupy a minimal to non-existent moral status, and go on to invoke this as a premise in a defense of meat-eating.<sup>ii</sup> Despite the disagreements between the two camps, both take it for granted that the philosophy of animal protection and the practice of avoiding meat rise and fall together.

Increasingly however, a new argument is being made that rejects this basic link. This new view endorses the philosophy of animal protection, but uses it to justify eating certain meats, particularly beef. The crux of the argument has to do with the accidental death of field animals during vegetable harvesting. Empirical studies suggest that the number of field mice, rats and similar creatures killed in crop cultivation may outnumber the total animal deaths involved in the raising of beef cattle, so long as the cows are raised on a diet of grass rather than grain. If so, then the most logical diet for animal advocates to adopt is one that includes

hamburger and milk from grass-fed cows, in order to reduce the overall number of animals killed.

This position—which we might call the burger vegan view, for reasons explained below—was first put forward by Steven Davis.<sup>iii</sup> The journal article in which Davis first outlined his theory has attracted noteworthy media attention, including favorable mentions in cover stories in *Time* and *The New York Times Magazine*, and a variation on Davis’s proposal involving beef and other meats has recently appeared in the philosophical literature.<sup>iv</sup> No doubt much of the attention is due to the novelty of Davis’s position. He offers an immanent critique of animal protection theory in general and the philosophy of Tom Regan in particular. Davis’s argument accepts Regan’s claim that, when it comes to making comparisons between non-human vertebrates, species is irrelevant to moral status: killing a mouse is just as wrong as killing a cow. Only unlike Regan, Davis thinks an argument based on this and related premises undermines, rather than supports, the case for a meat-free diet. Thus if Davis is correct, one of the leading advocates of animal protection will be hoist by his own petard on the central practical question his work engages, namely, what to eat.

Burger veganism is based on an ingenious argument, one that displays an elegant simplicity in the way it turns animal protection theory on its head. Despite its genuinely appealing qualities, however, burger veganism has some serious defects. To start with, the scientific studies on which Davis relies actually document two different forms of harm to field animals: there are those directly killed by harvesting equipment and those that become the prey of other animals. Once this distinction is made explicit, the degree to which such studies pose a

problem for animal protection theory considerably weakens. Davis also overlooks philosophically significant forms of harm to human beings that are present in beef production but not vegetable harvesting. Finally, he bases his argument on the implausible assumption that there is no difference between deliberate and accidental killing—either of an animal or a person. These problems ultimately prevent Davis from offering a successful critique of Regan.

If burger veganism's problems are severe, it does not follow that animal ethicists should pay it no heed. On the contrary, Davis has put his finger on an aspect of meat production which has major ramifications for vegetarian and vegan advocacy. Before pointing out this important feature, however, we need to examine the arguments for and against burger veganism itself.

### **The Davis Diet**

Some of the power of Davis's paper is illustrated by two vivid passages he quotes from other writers describing the death of field animals. From novelist Barbara Kingsolver: "She stopped speaking when her memory lodged on an old vision from childhood: A raccoon she found just after the hay mower ran it over. She could still see the matted grey fur, the gleaming jaw bone and shock of scattered teeth."<sup>v</sup> From hunting advocate Ted Kerasote: "When I inquired about the lives lost on a mechanized farm, I realized what costs we pay at the supermarket. One Oregon farmer told me that half of the cottontail rabbits went into his combine when he cut a wheat field, that virtually all of the small mammals, ground birds, and reptiles were killed when he harvested his crops. Because most of these animals have been seen as expendable, or not seen at all, few scientific studies have been done measuring agriculture's effects on their populations."<sup>vi</sup> Animal ethicists have sometimes used the image of an expanding

circle to express the idea that we should extend our moral concern outward to include animals. Davis essentially replies that if that is the case, then the circle will teem with all the animals of the field that are potential casualties of modern agriculture. As he points out, even a partial list of field animals in the United States would include opossum, rock dove, house sparrow, European starling, black rat, Norway rat, house mouse, Chukar, gray partridge, ring-necked pheasant, wild turkey, cottontail rabbit, gray-tailed vole, and many different species of amphibian.<sup>vii</sup>

Davis's critique of Regan begins with an estimate of the percentage of field animals killed in crop harvesting. Davis derives his estimate from two scientific studies, the first of which was conducted in England, and examined the effect of wheat and barley farming on mouse populations.<sup>viii</sup> The scientists found that the number of mice per hectare declined from 25 to five after harvesting. As Davis notes, "This decrease was attributed to both migration out of the field and to mortality. [The authors] estimated the mortality rate to be 52%."<sup>ix</sup> The second study, conducted in Hawaii, found that sugarcane production inflicted a 77% mortality rate on Polynesian rats.<sup>x</sup> Davis concludes that the average number of animals killed by agriculture will be somewhere between 52 and 77%, and settles on 60% as a rough approximation. Assuming that the population density of 25 mice per hectare cited in the English grain paper is typical of field animals in general, Davis writes, then we can calculate the average number of field animals killed in any agricultural operation to be 60% of 25, or 15 animals per hectare per year.

Davis contrasts this mortality rate with that caused by grass-fed beef raised on a pasture-forage model. Pasture foraging requires fewer passes through the

field with tractors and farm equipment than does intense crop production. For that reason alone, Davis writes, it is likely to reduce the number of field animals killed. But that number can be reduced even further when grazing cattle are used to harvest the forage, converting it into beef and milk. There are no statistics available regarding exactly how many field animals are killed in pasture-forage cultivation, but Davis says it is reasonable to assume it would be only half the number killed in crop production, or 7.5 dead animals per hectare.

There are 120 million hectares of cropland in the United States. If all of that land were used to harvest plant food, and if 15 animals were killed per hectare, the total number of animals killed every year would be 1.8 billion. Davis calls this arrangement the vegan model. He contrasts it with an agricultural system under which only half of American cropland is devoted to plant food, while the other half supports ruminant cattle raised on a grass diet. We can call this arrangement the Davis model. The question Davis seeks to answer is how many dead field animals his model would result in. He calculates the answer according to the following formula:

$$60 \text{ million hectares, plant production} \times 15 / \text{animals/ha} = 0.9 \text{ billion}$$

$$60 \text{ million hectares, forage production} \times 7.5 \text{ animals/ha} = 0.45 \text{ billion}$$

$$\text{Total: } 1.35 \text{ billion animals}$$

The goal of Davis's analysis is to determine what diet best upholds Regan's least harm principle, which reads as follows: "Whenever we find ourselves in a situation where all the options at hand will produce some harm to those who are innocent, we must choose that option that will result in the least total sum of

harm.”<sup>xi</sup> Davis concludes that Regan should cease his longstanding advocacy of a vegan diet, and join Davis in a nice grass-fed steak (perhaps with some ice cream for desert). For the diet that actually embodies Regan’s least harm principle is one cultivated according to the Davis model, as it would kill 450 million fewer animals per year.

When Davis wrote his paper, 8.4 billion food animals were slaughtered in the United States annually. Over 8 billion were chicken, 37 million were cows, and the remainder were pigs and other species. In an important passage, Davis notes that even if his proposal resulted in a large increase in the number of cattle killed to compensate for the decrease in chicken, it would still be superior to a plant-only system. “Even if the numbers of cows and calves killed for food each year was doubled to 74 million to replace the 8 billion poultry, the total number of animals that would need to be killed under this alternative method would still be only 1.424 billion, still clearly less than in the vegan model.”<sup>xii</sup>

Davis argues that his model is superior to several other proposals that have been put forward. People For the Ethical Treatment of Animals, for example, has made the (surely facetious) suggestion that if we continue to eat meat, we should consume the largest animals possible—blue whales—in order to reduce the overall number of food animals deaths. Davis says this would be impractical, as it would be impossible to kill enough whales without driving the species to extinction. A different version of the largest-animal-possible proposal would see people dining on elephants and draft horses, which can grow to twice the size of cows. Davis argues that this is unlikely to happen, however. Otherwise, there would already be more people willing to eat horses.

This, then, is Davis's argument. Before going on to critically assess it, it is worth recalling that Davis puts his pasture-ruminant model forward as an alternative to veganism. Yet whether this is true depends on how we understand veganism. Many common definitions do characterize it according to a list of particular prohibitions involving food and other animal products. A more plausible definition, however, characterizes it as a commitment to the principle of least harm itself. According to the advocacy group Vegan Outreach, for example, veganism "is about lessening suffering and working for animal liberation as efficiently as possible."<sup>xiii</sup> As one of the organization's founders puts it, "the issue . . . isn't, 'Is this [food] vegan?' Rather, the important question is: 'Which choice leads to less suffering?' Our guide shouldn't be an endless list of ingredients, but rather doing our absolute best to stop cruelty to animals."<sup>xiv</sup> Vegans disagree among themselves as to whether some foods, such as honey, are vegan or not.<sup>xv</sup> Among the benefits of defining veganism in terms of harm reduction is that it treats disagreements over any particular food as secondary, and emphasizes instead the underlying belief ethical vegans have in common.

On this view the Davis diet is itself a variant of veganism. I believe this is a more accurate way to describe it than Davis's own characterization. Davis, it should be noted, does not challenge the principle of harm reduction, merely its prohibition against consuming beef and dairy products produced from grass-fed cattle. (Although he does not mention it, his proposal could also justify wearing leather, which vegans normally object to). Changing one's lifestyle due to a commitment to reducing animal suffering would entail rejecting many practices and institutions that are now common, including wearing fur, hunting, visiting roadside and perhaps other zoos, cockfighting, the seal hunt, trapping—in short,

the familiar list of things animal protectionists condemn. As for eating habits themselves, it is worth noting that only 2.8 percent of Americans call themselves vegetarian and of those only one third, or roughly 0.9% of the total population, are vegan.<sup>xvi</sup> Davis's rejection of all poultry-related products places him among the one percent of society that objects to eating eggs on ethical grounds.

Characterizations of Davis's disagreement with Regan that frame it as a choice between meat-eating and vegetarianism are therefore not accurate.<sup>xvii</sup> At stake in the debate are really two different diets that seek to radically reduce the amount of harm inflicted on animals. In short, two different versions of veganism.

### **The wheat and sugarcane studies**

Davis's discussion of field animal deaths highlights a previously overlooked type of animal harm, one that, to my knowledge, no previous animal protection theorist has identified. For that reason alone, animal advocates are in his debt. Reading Davis's highly original paper one has the immediate sense that it contains an important argument that must be grappled with. Indeed, I would go so far as to say that Davis has offered the most thought-provoking response to animal protection philosophy since the ethical debate over animals began in earnest 30 years ago.

But is Davis's argument persuasive? Looking at it carefully reveals it to have significant problems, beginning with the conclusions Davis draws from the empirical studies he cites. Start with the English mouse study. The researchers actually found that the number of animals killed directly by farmers at harvest time was fairly small. One of their experiments, for example, examined the survival rates of 33 radio-collared mice before and after harvest. Only one mouse was killed by the combine harvester, a death rate of 3%. After the harvest, the



scientists went on to track eight mice during hay bailing. This phase of cultivation killed zero mice. A third experiment involved stubble burning, when the remaining hay stalks are set alight to clear the field. Here the researchers did find a significant death rate, affecting two out of five mice they tracked, or 40%.<sup>xviii</sup> But not only is that figure lower than the 52% mortality rate Davis derives from the study, the researchers themselves note that it is difficult to draw any conclusions from an experiment with such a small sample size. It should also be noted that burning is not an inevitable aspect of wheat or barley cultivation. The stubble can be plowed back into the field or eliminated in the same manner Davis's paper highlights, namely, by allowing ruminant animals to graze on it. Given these considerations, it is perhaps unsurprising that Davis does not include the stubble burning experiment in his calculations.

So where does the 52% figure come from? It actually concerns the number of animals that were killed by other animals after the crop was removed. One such animal the researchers observed were tawny owls. As the authors note, harvesting the field deprived the mice of their protective cover, making them more exposed to their natural predators:

[O]wls changed their hunting behaviour at harvest. Prior to harvest, they rarely hunt farmland. When they do, they concentrate particularly on the grassy banks bordering hedgerows since the crop prevents them from stooping on prey. Immediately following harvest, however, the owls fly low over the fields and stoop onto prey both in the stubble and directly into the straw lines left by the combine.<sup>xix</sup>

The effect of owls and weasels, another local predator, was far more dramatic than the farm machinery. Seventeen of 32 radio collared mice disappeared in the

week after harvesting. In nine cases the scientists actually saw the mouse killed or came upon evidence, such as chewed collars in weasel nests, after the fact. While it is impossible to rule out the possibility that some of the other missing mice simply fled the field, the researchers were monitoring for this possibility and conclude that it is more reasonable to assume that all 17 disappeared rodents were taken by predators.

The fact that these deaths were caused by animals rather than human beings poses a problem for Davis's argument. The animal protection movement as a whole has long drawn an ethical distinction between animals killed by people vs. those killed by animal predators.<sup>xx</sup> Tom Regan is no exception. As he writes, "in claiming that we have a prima facie duty to assist those animals whose rights are violated, therefore, we are not claiming that we have a duty to assist the sheep against the attack of the wolf."<sup>xxi</sup>

Animal philosophers offer different rationales for the predation exception. Singer, for example, makes a practical argument, saying that it would be impossible to police nature, so the issue is moot. Michael Allen Fox agrees with Singer, but also argues that saving mice is the same as depriving owls of their fulfillment, and so itself involves a form of harm. Regan for his part bases the distinction on the fact that predators cannot engage in moral reasoning. Wolves and owls are not themselves moral agents, so they cannot be said to have moral duties. The obligation to avoid directly harming animals is therefore one that only human beings must uphold. In the case of the owls hunting the mice, on Regan's view it is irrelevant that a human action, cutting down the barley, allows the owls to better see their prey. The mere fact that the mouse is harmed by a

non-human animal is enough, according to Regan's philosophy, to make it morally unobjectionable.

The fact that Regan makes an exception for predation brings Davis to a fork in the road. On the one hand, Davis could conceivably reject the predation exception. Simply in virtue of the fact Regan offers a theory of animal protection, Davis might hypothetically argue, means that Regan is obliged to condemn both human harm to animals and predation. Were Davis to take this line of attack, however, he would only create problems for himself. The charge that an ethical concern with non-human suffering entails condemning predation, and so policing nature, is often made by critics of animal protection. Usually it is put forward as a *reductio ad absurdum* to show that animal protection theory is not worth taking seriously. However, it is far from clear that Regan or any other animal protectionist is in fact obliged to condemn predation. As Fox points out, many animals are wired to hunt, and preventing them from exercising this capacity may deprive them of something essential to not only their own flourishing, but essential to the continued existence and flourishing of nature itself.<sup>xxii</sup>

Moreover, in the case of the mouse study, the authors themselves note that although cutting down the crops is a disaster for the mice, it is a bonanza for younger owls and weasels, many of whom would die without the food source harvesting makes available.<sup>xxiii</sup> All things considered, harvesting the field might even do more good for animals than harm, as it is possible that many of the mice will die soon anyway. As the authors write, "Whilst the mortality of the arable wood mouse population at harvest is dramatic, many of the animals killed at this

time of year are nearing their natural life expectancy, and it may be that the predation corresponds to a 'doomed surplus.'"<sup>xxiv</sup>

Even leaving such considerations aside, however, the nature of Davis's own argument obliges him to draw a distinction between animals killed by human beings and predation. Were Davis to maintain that we are obliged to prevent animal suffering in nature, it would not lend support to his argument concerning field mice run over by harvesters. Rather it would drain his position of any plausibility—the idea that we have an obligation to police nature is considered ridiculous for good reason. Such a stance would also be at odds with Regan's position regarding predation. Davis's critique, however, derives its distinctiveness and force precisely from the fact that it starts from within Regan's own philosophy. Such a project would be rendered pointless by an argument that called one of Regan's major premises into question.

To preserve the original and immanent quality of his argument Davis needs to take the second fork, to take the path that stays within Regan's premises. Very well, Davis might say, I accept that acts of predation cannot be invoked as part of an immanent critique. So in the case of the English mouse study, the relevant percentage is not 52% predator deaths, but 3% killed directly by the combine harvester. According to Davis's estimate of 25 animals per hectare, that works out to 0.75 deaths per hectare. If we plug that figure back into Davis's model involving 60 million hectares of farmland devoted to raising plant food, the overall death total is not 0.9 billion, but 45 million. That is less than the 74 million cattle deaths Davis allows in his preferred agricultural system, to say nothing of however many field animals are accidentally killed in cattle pastures (let alone all the coyotes and other predators ranchers must shoot to protect their herds).<sup>xxv</sup>

That leaves Davis with the sugarcane study.<sup>xxvi</sup> Here he would appear to be on stronger ground. The death rate it found regarding rats did not include deaths due to predators: the 77% mortality rate was entirely from rats killed by harvesting machinery. Davis, however, makes a small mistake by citing this as an annual death rate. Hawaiian sugarcane has a longer growing time than other crops. The wheat and barley in the English mouse study, for example, were harvested once a year. Hawaiian sugarcane has a two-year growing season (the authors of the sugarcane study note it varied from 22 to 38 months in 1970, the year the study was conducted). We therefore need to cut the 77% figure in half (assuming a 2-year season) to get the real annual number of 38.5%. That is still a significant mortality rate of 9.6 animals per hectare, larger than Davis's original estimate for grass-fed beef production. So even granting the lower death rate in the English mouse study, Davis might say, his argument still stands.

However, it is important to recognize the differences between the two studies, which describe very different agricultural processes. The authors of the Hawaiian study note that in sugarcane production, the field is first set alight to burn away dead leaves. As the scientists go on to write, "then a v-cutter (a caterpillar tractor equipped with a snowplow-like device) cuts the stalks at ground level and leaves them in [rows]. Pushrakes (caterpillar tractors with brush rakes instead of bulldozer blades) push the cane into piles. Self-loading transporters pick up the [rowed] stalks and haul them to a loading point from which they are transferred to trucks and hauled to the mill."<sup>xxvii</sup>

This is quite unlike the process the mouse study describes. Indeed, in one respect the harvesting methods actually have opposite outcomes. As we saw, one of the experiments in the mouse study suggested that burning the stubble killed

the most animals. The sugarcane study, by contrast, found that the rats always survived the fire. What really did them in were the tractors, which often ran them over (in a few cases, the rats were inadvertently transported by truck to the sugar mill and put through the washer). Importantly, the sugarcane study makes no mention of combine harvesters, just as the mouse study does not refer to tractors.

When the differences between the studies are made explicit, we see what a leap Davis makes in using them to determine an average annual death rate for all agriculture harvested in the continental U.S. (where neither study was conducted). One could just as easily conclude from the same research that every different form of crop harvesting has a different mortality rates for field animals, and that a national average will need to be based on more than two studies. Alternatively, it might be the case that most forms of agricultural production are more like wheat than sugarcane harvesting, or use combines rather than caterpillars. If so, then Davis's analysis would have little relevance beyond the sugarcane sector (which vegans should perhaps hope to see replaced with sugar beets, which grow beneath the soil and already account for over 50% of U.S. sugar production.)<sup>xxviii</sup> After reading the same studies as Davis, my own conclusion is that the science of estimating field animal deaths is still in its infancy, and is not a good basis on which to make large-scale recommendations. Davis himself concludes that more research is needed in this area.<sup>xxix</sup> But we do not know enough to make even the rough calculations that Davis offers.

### **Land fertility and agricultural harms to human beings**

Nonetheless, suppose that we give Davis the benefit of the doubt. Suppose that more studies are done, and they find that Davis's original mortality rate is

typical of American agriculture as a whole. Even if that were the case, Davis's analysis would still suffer from two problems that defeat his attempt to offer an immanent critique of Regan.

The first problem has already been pointed out by Gaverick Matheny. Davis's calculations are based on the assumption that one hectare of land devoted to grazing cattle produces as much food as one hectare devoted to crops. In fact, crop production takes much less land to produce a similar amount of food. Matheny notes that in one year, 1,000 kilograms of protein can be grown in one hectare of cropland planted with soy and corn. It would require 2.6 hectares of pasture for dairy cows fed on grass to produce the same amount of protein, and 10 hectares for grass-fed beef cattle to do so.<sup>xxx</sup> So even if we allow Davis his original estimates that 15 animals die per hectare in crop production, and that only half as many are killed by pasture foraging, the comparative superiority of the Davis model is undone by the fact that it will require far more hectares. As Matheny points out, adults are recommended to have 20 kilograms of protein annually. Given Matheny's revised calculations regarding land fecundity, a vegan would kill 0.3 field animals to obtain that amount, a lacto-vegetarian would kill 0.39, and someone on the Davis diet would kill 1.5.<sup>xxxi</sup> In other words, if Davis's analysis turned Regan on his head, the effect of Matheny's response is to turn Regan right side up again. As Matheny puts it, "[after] correcting Davis's math, we see that a vegan-vegetarian population would kill the fewest number of wild animals, followed closely by a lacto-vegetarian population."<sup>xxxii</sup>

Matheny's objection is a powerful and important one. However, the productivity of all forms of agricultural land has increased over time and there is a possibility (however remote) that grazing land may experience a productivity

boom at some point in the future.<sup>xxxiii</sup> Matheny's argument would also seem to leave open the question of what to do with land that is not suitable for crop production, yet which could support ruminant animals. Finally, suppose it turns out there is some particular type of vegetable that involved extremely high field-animal mortality rates, so high that when the harvesting method of the especially bloody vegetable is compared to raising dairy cows, harvesting the vegetable results in a higher number of animal deaths—even after Matheny's corrections are taken into account. If that were the case Matheny's criticism would not apply to dairy products from grass-fed animals. Yet even if so—even if all three of the issues mentioned here were resolved in Davis's favour—the Davis diet would still not displace traditional veganism as the dietary embodiment of Regan's philosophy.

More than just animals are accidentally harmed by agriculture and food production. People die as well. And if we are going to count every last field mouse run over by the combine harvester, surely we should also weigh harm to humans in the scale. Leave aside for the moment how many animal deaths one human death is worth. Instead, let us start by simply asking if there are aspects of beef production that make it potentially more hazardous to human beings than crop harvesting.

I can think of four. The first is manure, which is a carrier of *E. coli*, cryptosporidium and other causes of disease. In 2000 seven people in Walkerton, Ontario died from *E.coli* poisoning after manure from a cow farm leaked into the town's improperly filtered water supply.<sup>xxxiv</sup> A 1993 outbreak of Cryptosporidium infection in Milwaukee, meanwhile, killed 100 people.<sup>xxxv</sup> Grass farmers sometimes say that when their animals are fed grass rather than grain it



eliminates the possibility of *E. coli* infection, but the only scientific study on this issue of which I am aware found that there is no significant difference between the amount of the potentially deadly strain of *E. coli* produced by grain- and grass-fed cows.<sup>xxxvi</sup> Regardless, it seems reasonable to assume that compared to a vegetable crop system—which can be fertilized without manure—Davis’s model will result in the greater chance of human harm, due to the higher probability of catching any of a variety of manure-borne diseases.

Then there are farm accidents. An old show business adage says never work with children and animals, because both are unpredictable. The truth of that remark regarding animals is confirmed by a National Institute for Occupational Safety and Health study which found that farmers that work with beef, hogs and sheep had more lost-time injuries and restricted workdays than farmers who raise cash grain, field crops, fruit, vegetables, nuts or nursery-raised food.<sup>xxxvii</sup> A second study, documenting animal-related workplace fatalities, found cattle kill approximately 24 people every year. The most common methods of death were either being directly attacked (especially by bulls) or by being crushed by a falling animal. One person died of cardiac arrest after being hurt by a stun gun used to direct cattle, while 15 others died when their cars hit cows that had escaped from a field.<sup>xxxviii</sup> We can only imagine what the figure would be if the current number of cattle were not only doubled, as Davis’s model encourages, but released from the cramped feedlots that currently typify the U.S. beef industry and allowed to graze in pastures, a significant proportion of which would no doubt be located along highways.

Food animals need to be killed, and that requires slaughterhouses. Working in one has been called the most dangerous job in the United States.<sup>xxxix</sup> In large

part this is because most of the work must still be done by hand. While chicken slaughter plants are easily mechanized due to the breeding of uniformly sized chickens, cattle come in all sizes and shapes, and vary in weight by hundred of pounds. As Eric Schlosser notes, “the lack of a standardized steer has hindered the mechanization of beef plants. In one crucial respect meatpacking work has changed little in the past hundred years . . . the most important tool in a modern slaughterhouse is [still] a sharp knife.”<sup>xi</sup> As a result, not only do slaughterhouse employees often stab themselves or other workers, but because of the repetitive nature of their work, they have the highest cumulative trauma injury rate in American industry, 33 times the national average.<sup>xii</sup>

Finally, there is methane. When cows belch or pass gas they release it into the atmosphere. According to the Environmental Protection Agency, U.S. cattle alone emit 5.5 million metric tons of methane per year, and cows account for 19% of the globe’s human-related methane emissions.<sup>xiii</sup> Methane is a greenhouse gas, and as I write there is widespread debate and concern as to whether such gasses are causing global warming. If global warming fears do turn out to be correct, then cattle agriculture on the scale Davis envisions could well prove to be a harm, not only to the environment, but to human beings as well.<sup>xiiii</sup>

What difference do these four possible sources of human harm make? No doubt farmers who grow wheat are sometimes crushed when their harvesters flip over on them. But I take the potential sources of harm mentioned above to show that raising beef is likely to kill at least one more person a year than would an agriculture system not involving cattle. This is important to note given that Davis’s goal is to offer an immanent critique of Regan. If Regan ranks the death of even one normal human adult as infinitely more serious than the death of an

animal, that would provide Regan with strong grounds for rejecting Davis's model. Even though Davis's model might save a few animal lives, Regan could reply, it is not worth it if it involves more dead people.

Regan does in fact rank the death of a person as far worse than the death of any animal. This is hardly surprising. Few beliefs cut more deeply in our consciousness than the notion that killing a person is worse than killing a mouse, and it is difficult to imagine a theory of animal protection being plausible if it implied that human and animal deaths were morally indistinguishable. Regan demonstrates how his theory respects this common-sense belief in a discussion of a lifeboat that only has four seats. If we have to choose between five potential passengers, four of them human and one canine, who should be thrown overboard? Regan gives the same answer any normal person would, namely, the dog. Crucially, however, Regan goes on to note that his answer would be the same even if there were many more dogs. Indeed, it is worth stressing that for Regan, killing one person is worse than killing any number of animals. "Let the number of dogs be as large as one likes; suppose they number a million," Regan writes. "The million dogs should [still] be thrown overboard and the four humans saved."<sup>xliv</sup>

This passage should be borne in mind the next time a critic charges that animal protection is about elevating animals to the same level as people. More to the point, it illustrates the principle Regan urges us to take into account when deciding between two options which involve different levels of harm to human beings. If killing an infinite number of animals would prevent one human death, then we should kill the animals. Regan is happy to make this allowance, for as he notes, the overwhelming majority of the harms currently inflicted on animals are

not done to save human lives, but simply to provide entertainment (as in hunting) or because people prefer the taste of chicken and other meats over equally nutritious vegan food.<sup>xlv</sup> As Regan puts it, “What the rights view implies should be done in exceptional cases—and prevention cases, including lifeboat cases are exceptional cases—cannot fairly be generalized to unexceptional cases.”<sup>xlvi</sup> Given the four harms listed above, raising beef will likely kill more people than raising vegetables. The vegan model can therefore be justified as a prevention case, and Regan once again wiggles out of Davis’s trap.

Of course, Regan’s discussion of the lifeboat scenario can be criticized. Peter Singer, for example, has asked whether Regan’s endorsement of killing animals to prevent harm to people is compatible with Regan’s total ban on animal experiments, some of which are conducted in the hope of curing fatal human diseases.<sup>xlvii</sup> But even if we grant Singer’s criticism, which has the effect of making experiments on animals ethically justifiable under certain circumstances, that is irrelevant to Davis’s argument with Regan about food animals (it would only be relevant if we were deciding between eating an animal and eating a person). Moreover, as with the predation exception, offering this criticism would substantially change the nature of Davis’s criticism. It would again involve sacrificing the immanent nature of his argument, and replacing it with a direct challenge to one of Regan’s premises.

### **Accidental vs. deliberate killing**

A defense of traditional veganism that stresses the human harms of beef cultivation may seem strange. The goal of Regan’s book, after all, is to offer a theory of animal rights. Isn’t it somehow missing the point to mount a defense of *veganism* of all things, that stresses the profound superiority of human life?

Doesn't this render irrelevant the killing of animals, not only in wheat and cow fields but also in slaughterhouses?

A human-centred defense of veganism strikes me as no more outlandish than a case for beef eating justified in the name of animal protection. Moreover, this objection overlooks the fact that classifying grass-fed beef as a prevention case treats it as an exception. Even while advancing the human-centred argument against eating grass-fed beef, a proponent of Regan's theory can continue to make direct appeal to the value of animal life when condemning hunting or eating chicken and pork—not to mention practically all U.S. beef as it is raised now. In short, Regan's primary animal-centred argument can still be made against nearly all types of animal harm.

However, the uneasy feeling that accidental harms to people shouldn't be the decisive factor is nonetheless an intuition worth pausing over. What it should draw our attention to is a key premise of Davis argument, namely, that there is no moral distinction between accidental and deliberate harm. As he writes in contrasting deliberately killed cows and accidentally killed mice, "the harm done to the animal is the same—dead is dead."<sup>xlvi</sup> This notion is central to Davis's criticism of Regan, as it is what justifies calculating accidental and deliberate harms as indistinguishable wrongs.

However, Davis makes a strange remark in justifying his equal ranking of the two forms of killing. It occurs in the following passage: "[Angus] Taylor says about the questions of intent, 'A utilitarian is likely to see no moral difference between the two, since utilitarianism holds that it is consequences that count and not intentions.'"<sup>xlix</sup> The reference to utilitarianism is strange because Regan's argument is based on deontological rights theory, utilitarianism's great modern

rival. Davis does not cite any passage in which Regan himself calls into question the distinction between accidental and deliberate killing, and I am unaware of any instance where Regan does so. So Davis's immanent critique, it turns out, silently depends on a premise that Davis himself introduces. The real question his paper raises, then, is whether it is plausible to say there is a difference between accidental and deliberate harms.

I believe there is. In most legal systems, the difference between accidental and deliberate killing is the difference between manslaughter and murder. Applied to animals, surely we recognize a distinction between accidentally hitting an animal while driving on the highway and intentionally backing over it with the express aim of ending its life. At the very least, it is far from clear that someone like Regan, who urges us to take seriously the moral claims of animals, is obliged to say there is no difference between accidental and deliberate harms to animals. If we take the moral claims of human beings seriously and we draw a distinction between accidental and deliberate killing in their case, why can't any animal advocate who is not a utilitarian say the same thing when it comes to field mice?

This highlights the real significance of unintended human deaths caused by manure and other sources. They are a consistency test for Davis's argument. Davis judges Regan's argument by a standard that leaves no room for ranking accidents as lesser wrongs than intentional killings. Leave aside the fact that this is a punishing standard, one that makes many aspects of the justice system we currently take for granted seem ridiculous. Applying the same standard to Davis's argument, we see that it creates problems for his account as well. Only in Davis's case the accidents involve people, not animals. But Davis never gives us grounds for distinguishing between accidents involving people but not those

involving animals. Indeed, the quote he offers from Taylor could be read as challenging the significance of the distinction in the case of both animals and humans (which would surely be an extreme view).

Although Regan does not rank animals on a par with people, his theory does urge us to extend many common moral notions we reserve for human beings, such as rights, to other creatures. By that standard, the most plausible version of Regan's theory would be one that does make a distinction between accidental and deliberate deaths, in the case of both people and animals. If so, then the debate between Regan and Davis hinges on whether our everyday habit of distinguishing between deliberate and accidental harm makes sense. The more Davis seeks to preserve his challenge to Regan, the more he will have to attack this common-sense and, to my mind, reasonable distinction. Moreover, Davis will have to attack it in such a way that accidental deaths become just as important as deliberate ones in the case of animals, but not in the case of human beings. In other words, Davis must show that the accidental death of field mice is no different from deliberate killing and so important that it has ramifications for the agricultural sector as a whole; yet at the same time, he must maintain that the accidental deaths of human beings from *E. coli* and other aspects of beef production are not to be judged by such a high standard. Surely that would leave Davis, rather than Regan, with the less plausible argument.

### **Conclusion**

There are other criticisms one could make of burger veganism beyond those offered here.<sup>1</sup> I will end, however, by mentioning two positive features. The first is the important shift burger veganism represents in the debate over animals. When Tom Regan and Peter Singer first made their arguments for animal

protection, the reaction they received was ridicule and dismissal. It is a mark of just how far the debate has progressed that critics such as Davis no longer offer such a view, and instead mount critiques that begin from the premises of animal protection itself. As *Time* magazine put it in commenting on Davis, “even to raise the question of harvester Hiroshima is to show how far we have come in considering that which is not human.”<sup>11</sup> It is unlikely that we have heard the last of this line of analysis. Indeed, I would not be surprised if Davis represents the type of critic who will increasingly come to define the response to animal protection: one who seeks not to reject protection theory outright, but to modify it and point it in new directions. If this does not represent quite the degree of progress animal advocates hope for, it is a sign of progress nonetheless, and one for which we should be thankful.

Animal advocates can also learn something from Davis. It is not just that he should compel protectionists to pay greater attention to farming methods and lobby for harvesting technologies that directly kill fewer field creatures. As a professor of animal science, Davis comes to the protection debate with an intimate familiarity of animal husbandry. One of the challenges of advancing protection theory is that doing so amounts to asking people to accept a lifetime homework assignment regarding their diet. Rightly or not, this can cause people to reject the philosophy. Davis’s work, however, raises the possibility of an intermediate step, one that falls short of veganism or even vegetarianism, but which still represents a meaningful dietary change. This occurs when Davis notes that the average slaughtered cow represents 1,200 lbs. of meat, whereas the average chicken only provides 6 lbs. (Hence the eight billion chicken killed every year, compared to only 37 million cattle).



This simple difference between animal carcasses, surely obvious to any farmer, has potentially major implications for animal advocacy. On the one hand, it should cause animal advocates to recognize that not all meats are created equal. In terms of the number of animals killed, one serving of chicken represents 200 servings of beef. Causing someone to give up chicken before beef would thus be a victory in itself. Although eliminating chicken alone should not replace veganism as animal protection's ideal, it deserves serious consideration as the first step people are asked to take when it comes to changing their diet. This is especially so when one considers the large number of people who cut out red meat but keep eating chicken. They may actually be doing more harm than good when it comes to the overall number of animals killed, depending on whether their chicken consumption increases. In short, the issue of carcass size deserves far more attention than animal advocates have given it.

It is practical and immediate questions of this kind, rather than large-scale blueprints for national agricultural reform, that represent burger veganism's real potential contribution. Until such questions receive further consideration, however, we should continue to affirm a traditional conception of animal ethics. A conception that says if we are committed to protecting animals, it follows that we won't eat them.

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<sup>i</sup> Tom Regan, *The Case for Animal Rights* (Berkeley: University of California Press, 1983). Peter Singer, *Animal Liberation*. Second ed. (New York: New York Review of Books, 1990). Michael Allen Fox, *Deep Vegetarianism* (Philadelphia: Temple University Press, 1999).

<sup>ii</sup> R.G. Frey, *Interests and Rights: The Case Against Animals* (Oxford: Clarendon Press, 1980). Michael P.T. Leahy, *Against Liberation: Putting Animals in Perspective*. Second ed. (New York: Routledge, 1994). Peter Carruthers, *The Animals Issue: Moral Theory in Practice* (Cambridge: Cambridge University Press, 1992).

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- <sup>iii</sup> Steven L. Davis, "The Least Harm Principle May Require That Humans Consume a Diet Containing Large Herbivores, Not a Vegan Diet," *Journal of Agricultural and Environmental Ethics* 16, no. 4 (2003): 387-94.
- <sup>iv</sup> For media stories mentioning Davis see Richard Corliss, "Should We All Be Vegetarians?," *Time*, July 15, 2002, 30. Michael Pollan, "An Animal's Place," *The New York Times Magazine*, November 10, 2002, 100. Lee Dye, "Researcher: Vegetarian Diet Kills Animals Too," ABC News, May 1, 2002. <http://abcnews.go.com/Technology/story?id=97836&page=1> (accessed April 12, 2006). For the philosophical variation on Davis's proposal see George Schedler, "Does Ethical Meat Eating Maximize Utility?," *Social Theory and Practice* 31, no. 4 (2005): 499-511.
- <sup>v</sup> Quoted in Davis, "Least Harm," 388.
- <sup>vi</sup> *Ibid.*, 389.
- <sup>vii</sup> *Ibid.*, 389.
- <sup>viii</sup> T.E. Tew, and D.W. Macdonald, "The Effects of Harvest on Arable Wood Mice *Apodemus Sylvaticus*," *Biological Conservation* 65 (1993): 279-83.
- <sup>ix</sup> Davis, "Least Harm," 389.
- <sup>x</sup> Roger D. Nass, Glen A. Hood, and Gerald D. Lindsey, "Fate of Polynesian Rats in Hawaiian Sugarcane Fields During Harvest," *Journal of Wildlife Management* 35, no. 2 (1971): 353-56.
- <sup>xi</sup> Quoted in Davis, "Least Harm," 388.
- <sup>xii</sup> *Ibid.*, 391.
- <sup>xiii</sup> Vegan Outreach, "Defining 'Vegan,'" <http://www.veganoutreach.org/advocacy/definingvegan.html> (accessed April 7, 2006).
- <sup>xiv</sup> Matt Ball, "How Vegan?," <http://www.veganoutreach.org/enewsletter/20051005.html> (accessed April 7, 2006).
- <sup>xv</sup> The debate over honey has to do with whether or not honeybees warrant moral respect. Most animal philosophers exclude insects from the realm of moral concern, on the grounds that they are not vertebrates and do not have a central nervous system or nociceptors (pain receptors) in their brains. See Gary Varner, *In Nature's Interests?: Animal Rights and Environmental Ethics* (Oxford, Oxford University Press, 1998), for a summary of six studies which collectively suggest that insects, unlike vertebrates, do not feel pain. (For an online summary of Varner's research, see <http://philosophy.tamu.edu/~gary/intro/pain.html>). Some vegans, however, argue that simple conscious awareness, rather than suffering, is the foundation of moral respect, and so eschew products made from insects. I assume this second group represents only a tiny proportion of vegans, but am unaware of any survey data.
- <sup>xvi</sup> Vegetarian Resource Group, "How Many Vegetarians Are There?," <http://www.vrg.org/journal/vj2003issue3/vj2003issue3poll.htm> (accessed April 7, 2006).
- <sup>xvii</sup> See the three media stories mentioned in note 4 for characterizations of this kind. Also note the title of Gaverick Matheny's article, mentioned in note 30.
- <sup>xviii</sup> The researchers note that whether or not the mice were killed by the fire depended on the location of their burrow: "Both mice that were killed by stubble burning had burrows directly below the straw lines, where the stubble fire burnt

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most fiercely. All three survivors had burrows between the straw lines. Post-mortem examination suggested that the mice had been asphyxiated by the stubble fire, and it is likely that as the fire passed overhead it drew the air out of the burrow system." Tew and Macdonald, "The Effects of Harvest," 282.

<sup>xix</sup> Ibid., 282.

<sup>xx</sup> See Singer, *Animal Liberation*, 226; Fox, *Deep Vegetarianism*, 163.

<sup>xxi</sup> Regan, *Animal Rights*, 285.

<sup>xxii</sup> In citing Michael Allen Fox's argument for the predation exception, I am aware that I am not offering a purely immanent defense of Regan. Like Fox I believe the inability of predators to engage in moral reasoning is a relevant consideration, but is not by itself sufficient grounds to justify an exception for predation (For criticism of Regan on this score see Dale Jamieson, "Rights, Justice and the Duty to Provide Assistance: A Critique of Regan's Theory of Rights," *Ethics* 100, no. 2 [1990]: 349-62). However, this strikes me a minor deviation from Regan compared to the one I criticize in Davis below.

<sup>xxiii</sup> Tew and Macdonald, "The Effects of Harvest," 282.

<sup>xxiv</sup> Ibid., 282.

<sup>xxv</sup> In fairness to Davis, the number of predator animals killed by ranchers is much smaller than the number of food animals. In the U.S. during 2002 they amounted to 86,000 coyotes, 5,000 foxes, 380 black bears and 190 wolves. Erik Marcus, *Meat Market: Animals, Ethics and Money* (Ithaca, NY Brio, 2005), 198. On the other hand, Marcus also mentions a 98% decline in the prairie dog population, which numbered 5 billion at the end of the 19<sup>th</sup> century. This however, may be more of an environmental cost than anything else. On the issue of the environmental cost of animal agriculture, it has become common for animal advocates and environmentalists to claim that it takes 5,200 gallon of water to produce one pound of beef. Marcus convincingly debunks this apocryphal statistic, noting that "the environmental impact of meat production is far less costly than many vegetarian activists suggest." *Meat Market*, 195. Marcus, it is worth noting, is himself a vegan animal advocate.

<sup>xxvi</sup> On page 389 of his paper Davis also cites the following sentence fragment: "mowing of alfalfa caused a 50% decline in grey-tailed vole population." The fragment is taken from W. Daniel Edge, "Wildlife of Agriculture, Pastures and Mixed Environs," in David H. Johnson and Thomas A. O'Neil, *Wildlife-Habitat Relationships in Oregon and Washington* (Corvallis: Oregon State University Press, 2000). However, when one looks up the passage to which Davis is referring, it reads, "Edge et al. reported that mowing of alfalfa caused . . .". In other words, the sentence in question is itself a citation, and the ultimate reference is to W. Daniel Edge, Jerry O. Wolff, and Robert L. Carey, "Density-Dependent Responses of Gray-Tailed Voles to Mowing," *Journal of Wildlife Management* 59, no. 2 (1995): 245-51. When one turns to this second paper, it turns out to be a study of the effects mowing has on voles birth rates and migration patterns. Importantly, the scientists do not describe any voles being killed by the act of mowing itself. It is also worth noting that the study did not take place in an actual alfalfa field. Rather it was conducted at an experimental farm where alfalfa was planted inside 45 by 45 meter enclosures, which were "constructed of galvanized sheet metal extending approximately 1 m above ground and 0.6-1.0 m below ground level to prevent escape by burrowing rodents." Edge et al., "Density-Dependent

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Responses,” 246. A study with this aim and methodology is not relevant to a discussion of field animals killed by harvesters. Davis would appear to have misunderstood what Edge meant in his single-authored paper by population “decline.”

<sup>xxvii</sup> Nass et al., “Fate of Polynesian Rats,” 355.

<sup>xxviii</sup> United States Department of Agriculture, “U.S. Sugar Beet Farming—How ‘Sweet’ Is It?,”

<http://www.ers.usda.gov/AmberWaves/February05/Findings/Sugarbeets.htm> (accessed April 11, 2006).

<sup>xxix</sup> Davis, “Least Harm,” 393.

<sup>xxx</sup> Gaverick Matheny, “Least Harm: A Defense of Vegetarianism from Davis’s Omnivorous Proposal,” *Journal of Agricultural and Environmental Ethics* 16, no. 5 (2003): 509. Matheny suggests in a personal communication that crop land may in fact be even more productive than he originally estimated. At the outer limit, he writes, land devoted to grazing cattle in a cold climate is 67 times less productive than land devoted to soy crops. Matheny’s revised estimate is based on a soybean crop yield of 37 bushels per acre, with an average meal yield of 48 lbs per bushel, of which 48% is protein (figures taken respectively from (<http://www.unitedsoybean.org/soystats2002/statesoystats/cropyield.html>; <http://www.unitedsoybean.org/soystats2002/miraclecrop.html> and <http://www.ag.iastate.edu/aginfo/news/1997/soyquality.html>. Last checked October 29, 2006). That works out to 852 lbs protein per acre (37x48x0.48), or 955 kilograms protein per hectare. Grazing cows, by contrast, gain an average of 131 kilograms per hectare, with an average 0.42 kilogram of meat per kilogram of liveweight, and 0.26 kilogram of protein per kilogram of meat (figures taken respectively from <http://jas.fass.org/cgi/content/full/82/8/2503/T3>; <http://ars.sdstate.edu/MeatSci/May99-1.htm> and <http://www.calorie-count.com/calories/item/23502.html>. Last checked October 29, 2006). That works out to 14.3 kilograms of protein per hectare (131x0.42x0.26), or one 67<sup>th</sup> the amount produced from soy. As Matheny notes, pasture finished cattle might have a different total efficiency, and grass-fed cows in a hotter climates could be considerably more productive. Nonetheless, he believes his revised figures are more representative than those in “Least Harm.” For the purposes of rebutting Davis, the difference between Matheny’s 1:10 and 1:67 ratios is academic, so I have continued to use the 1:10 figure in the main text. Given Davis’s estimates regarding the number of animals killed in beef and crop farming, anything above a 1:2 ratio invalidates his argument.

<sup>xxxi</sup> *Ibid.*, 507.

<sup>xxxii</sup> *Ibid.*, 507.

<sup>xxxiii</sup> On land productivity see Lester R. Brown, *Plan B: Rescuing a Planet Under Stress and a Civilization in Trouble* (New York: W.W. Norton, 2003), 131-150.

<sup>xxxiv</sup> Denis R. O’Connor, “Report of the Walkerton Inquiry: The Events of May 2000 and Related Issues,” (Toronto: Ontario Ministry of the Attorney General, 2002).

<sup>xxxv</sup> It has never been shown that cattle feces was the cause in this particular instance I mention it only to give a sense of the damage *Cryptosporidium* can do. For more information see Wisconsin Department of Natural Resources,

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“Cryptosporidium: A Risk to Our Drinking Water,”

[Http://Dnr.Wi.Gov/Org/Water/Dwg/Crypto.Htm](http://Dnr.Wi.Gov/Org/Water/Dwg/Crypto.Htm) (Accessed April 8, 2006).

<sup>xxxvi</sup> N. Fegan, P. Vanderlinde, G. Higgs and P. Desmarchelier, “The Prevalence and Concentration of Escherichia Coli O157 in Faeces of Cattle from Different Production Systems at Slaughter,” *Journal of Applied Microbiology* 97, no. 2 (2004): 362-70.

<sup>xxxvii</sup> National Institute for Occupational Safety and Health, “Injuries among Farm Workers in the United States, 1993,” <http://www.cdc.gov/niosh/97-115.html>,” (accessed April 7 2006).

<sup>xxxviii</sup> Ricky Lee Langley and James Lee Hunter, “Occupational Fatalities Due to Animal-Related Events,” *Wilderness and Environmental Medicine* 12, no. 3 (2001): 168-74.

<sup>xxxix</sup> Eric Schlosser, *Fast Food Nation: The Dark Side of the All-American Meal* (New York: HarperCollins, 2002), 172.

<sup>xl</sup> *Ibid.*, 173.

<sup>xli</sup> Bureau of Labor Statistics, “Industries with the Highest Nonfatal Total Cases, Incidence Rates for Injuries and Illnesses, Private Industry, 1999,” (Washington D.C.: U.S. Department of Labor, 1999).

<sup>xlii</sup> U.S. Environmental Protection Agency, “Frequently Asked Questions.” <http://www.epa.gov/methane/rlep/faq.html> (accessed October 24, 2006). The FAQ figures are derived from U. S. Environmental Protection Agency, *U.S. Greenhouse Gas Inventory Reports Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004*. USEPA #430-R-06-002. April 2006. A separate study found that grazing management practices can reduce methane emissions by 22%. See H. Alan DeRamus, Terry C. Clement, Dean D. Giampola and Peter C. Dickison, “Methane Emissions of Beef Cattle on Forages: Efficiency of Grazing Management Systems,” *Journal of Environmental Quality* 32 (2003): 269-277. This study does not address whether methane-reducing management methods would be feasible on a wide scale, but even if so, it would not change the point at hand, which concerns the greater amount of methane produced by any type of beef farming compared to crop and vegetable cultivation.

<sup>xliii</sup> It is interesting to consider (as one anonymous reviewer suggested) whether a purely plant-based agricultural system would require more tractors and trucks than Davis’s model, and so produce a greater amount of carbon dioxide. To answer this question we would presumably need to conduct a detailed comparison of the amount of carbon dioxide produced by tractors and harvesters in vegetable and wheat fields vs. the amount produced by vehicles travelling to and from slaughterhouses. In addition, we would need to take into consideration the larger amount of plant crops in a vegan system which would convert carbon dioxide into oxygen through photosynthesis. Such factors lead me to suspect that a vegan model would not in fact produce more carbon dioxide.

<sup>xliv</sup> Regan, *Animal Rights*, 325.

<sup>xlv</sup> The nutritional value of vegetarian food is documented in American Dietetic Association and Dietitians of Canada, “Position of the American Dietetic Association and Dietitians of Canada: Vegetarian Diets,” *Journal of the American Dietetic Association* 103, no. 6 (2003): 748-765. The nutritional value of vegan diets is discussed in Ann Reed Mangels and Suzanne Havala, “Vegan diets for

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women, infants, and children," *Journal of Agricultural and Environmental Ethics* 7, no. 1 (1994): 111-122.

<sup>xlvi</sup> Regan, *Animal Rights*, 325.

<sup>xlvii</sup> Peter Singer, "Ten Years of Animal Liberation," *The New York Review of Books*, January 17, 1985: 46-52. Peter Singer, "The Dog in the Lifeboat: An Exchange," *The New York Review of Books*, April 25, 1985: 56-57.

<sup>xlviii</sup> Davis, "Least Harm," 392.

<sup>xlix</sup> *Ibid.*, 392.

<sup>1</sup> One is perhaps worth briefly mentioning. It concerns Davis's starting assumption regarding field animal density. He takes for granted a constant rate of 25 animal per hectare, regardless of species. The authors of the English mouse paper, however, found that traps they set caught mice with far greater frequency than bank voles and common shrews. See Tew and Macdonald, "The Effects of Harvest," 279. This suggests that field animal densities may vary across species.

<sup>ii</sup> Corliss, "Should We All Be Vegetarians?," 30.