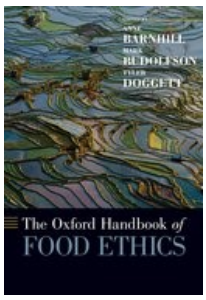

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CHAPTER

4 Food, the Environment, and Global Justice

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Abstract

This chapter identifies and critically examines a standard form of argument for organic and vegan alternatives to industrial agriculture. This argument faces important objections to its empirical premises, to its presumption that there is a single food system that minimizes harm and is best for the environment, and to the presumption that the ethically best food system for us to promote is the one that would be best in ideal theory or the one that would be best from the perspective of our own society. Instead, determining which food system should be promoted arguably requires a complex global, empirical, and ethical integrated assessment that includes a proper accounting for values of global justice in nonideal theory. This proper accounting arguably recommends sustainable intensification of food systems (as it is called in the food-science literature), which is importantly distinct from contemporary systems as well as from organic, local, and/or vegan-centered alternatives.

Keywords: food, ethics, agriculture, environmental ethics, global justice, organic, locavore, vegetarianism, sustainability, sustainable intensification

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In order to eat a single meal, would you dump thousands of gallons of water down the drain, dump pollutants into our rivers, kill the creatures that inhabit our ecosystems, and harm other human beings?

Of course, you wouldn't. But an average meal in a developed nation typically has exactly that kind of extensive harm footprint, given the resources that are used to produce it and other consequences of its production. The "harm footprint" of a unit of a food is the measurement of the amount of harm that the food system causes in producing each unit of that food on average. (See the chart later in this essay for quantification and comparison of the harm footprints of different foods.)

So, how should we take these different kinds of harms into proper account, including environmental harms, as well as the needs of humans? And in light of that proper accounting, what is it best to do about the

disturbingly large harm footprint that is associated with our food? What is the best improved food system for us to aim for with policy?

To some, the answer to this question is simple: we should promote a food system that simply minimizes each and every one of these negative impacts. But if this simple answer is understood to mean unconstrained minimization of all of these negative impacts, it has the striking implication that we should generally stop using the tools of contemporary agriculture altogether, even if this means that we cannot then produce enough food for ourselves—since choosing to produce food using the tools of contemporary agriculture will generally have negative impacts, particularly on the environment.

Most people would reject this unconstrained minimization view once it is noted that it could have this self-sacrificing implication. However, not everyone rejects such an answer, for example, many deep ecologists would say, "Yes, that is exactly what is implied by the values I endorse, which imply unconstrained
p. 68 minimization of negative impacts ↳ on ecosystems, even if it means the human population must wither away."[1] As such, deep ecologists and some other environmental theorists endorse the view that humans might have to make dramatic sacrifices on behalf of the environment.

In what follows, I assume for the sake of discussion that the correct answer to the question of what food system we should promote cannot have the implication that humanity as a whole should dramatically sacrifice itself. Thus, I will assume for the sake of argument that our pursuit of environmental and other objectives must be constrained by or balanced against meeting the basic needs of humans (and perhaps their further desires as well), contrary to the sort of environmental ethics endorsed by deep ecologists and some others.[2]

But even if we assume that meeting our need for food must constrain any acceptable answer, it may still seem relatively easy to answer the question of what food system we should promote: namely, that we should promote whatever system gives us enough (nutritious) food, and subject to that constraint also minimizes harm along every dimension we should care about, such as harm to our farmers, nonhuman animals, and our environment. In fact, many leading arguments in favor of particular alternative food systems—such as organic food systems or vegan food systems—can be understood as based on this "Standard Argument," combining this normative premise, together with an empirical premise to the effect that the favored food system would in fact minimize harm along every dimension we care about:

> **The Standard Argument**
>
> **Normative Premise**: We should promote the food system that provides us with enough nutritious food, and subject to that constraint minimizes harm along each and every normatively relevant dimension.
>
> **Empirical Premise**: Food system *X* (e.g., a local and organic system or a vegan system) would provide us with enough nutritious food, and subject to that constraint would minimize harm along each and every relevant dimension.
>
> **Conclusion**: Therefore, we should promote food system *X*.

p. 69 This chapter outlines a number of important objections to arguments that have this structure. First, the empirical premises of these arguments are called into question by the work of experts on the relevant empirical issues about food production. Second, the relevant empirical facts also calls into question the assumption that there is a single food system that minimizes harms along each and every dimension that matters. Instead, many experts would argue that the essence of the food-systems challenge is to decide what regrettable trade-offs it is best to make so that we can best salvage what matters overall—where the best overall food system is likely to be worse along some dimensions (including some environmental

harms) than some feasible alternatives. Finally, in order to answer questions about what food system our society should promote with policy, it is arguably necessary to first take the perspective of the entire world, and thus the global food system, and first answer questions such as: What global food system is best when everything is taken into proper account, including all of the global consequences for people and the environment of any local change we might make? And in light of this, how should rich and poor nations coordinate their efforts to achieve the optimal food system for the world, given the different capacities of nations, different levels of power in negotiations, and different levels of responsibility for the defects of the current system? What is our society's place in that optimal system? How exactly do these facts about the complex global system complicate the answer to these and other questions about what we should do from the perspective of our society?

The progression of these questions—beginning with questions that can seem to have answers that depend only on easily known facts about our society and our local environment, but that ultimately require a complex global empirical and ethical integrated assessment that includes a proper accounting for values of global justice—is arguably the future of debates about food and the environment, and is also representative of the arc of much of environmental ethics and policy over the past century.

This chapter also explains why some food-science experts believe that a correct global assessment ultimately recommends what is called *sustainable intensification* of food systems, which involves more elements of contemporary industrial agriculture than are favored by proponents of organic or vegan alternatives. As a further complication, this is not equivalent to the idea that sustainability should be our main objective. Various leading conceptions of sustainability are considered later in the essay, and none appear to capture a fundamentally important objective for societies.

The Pro-Organic View and the Challenge of Feeding the World

Returning to the large harm footprint of our food as it is currently produced, some commentators insist that the correct conclusion to draw is that we need to shift away from contemporary industrial agriculture and move back toward more traditional organic farming methods that avoid synthetic fertilizers, pesticides, and
p. 70 the inputs that drive ↳ many of these high harm footprints, and that we should also move back toward smaller-scale local food systems.[3] As a result, to the majority of these commentators, the answer to the question of what food system we should have is a function of facts about our regional foodshed, where a "foodshed" is roughly the geographic region that would most naturally produce the food for a particular population in the absence of a modern food distribution network.[4] So, for example, what food system should be promoted by people in Vermont is a function of facts about Vermont and its people and closely geographically connected areas, and what food system should be promoted by people in Uttar Pradesh is a function of different facts about people in that region and other closely geographically connected areas, and so on.

These "pro-organics" arguments often appeal to a number of values that local and organic agriculture is alleged to better promote: values of community, tradition, respect for nature, and, most important, better quality of food and minimization of negative environmental impacts. Beyond these, the main goal of the pro-organics view is generally taken to be maximizing soil health and biodiversity in foodsheds using agricultural practices that invoke ecologically natural processes (e.g., fertilizing fields with animal manure, ideally applied by the animals themselves as they graze and forage, as opposed to using synthetic fertilizer). As with many terms in public discourse, "organic" is usually not defined more precisely beyond this implicit definition in terms of these values and goals. (Note that most proponents of the pro-organic view bemoan the fact that more precise definitions of "organic" in policy, such as the definition used by the USDA, do not go far enough in ensuring these values and goals are promoted.) Given these values and goals, it is

unsurprising that many who endorse the pro-organics view gravitate toward *permaculture*, where the focus is on creating and maintaining agriculturally productive ecosystems that have the diversity, stability, and resilience of natural ecosystems—and are a seamless part of the local socioecological system, perhaps providing other ecosystem services for local populations of the sort common in the preindustrial era.

Pro-organics arguments typically depend implicitly on the assumption that such an organic and local system does not do worse on any relevant dimension. Thus, leading arguments for the pro-organics view typically have the structure of the Standard Argument, even though many details of such an argument are
p. 71 typically left unstated and taken for granted by proponents of the view.[5] ↳

There are two main objections to this pro-organics view. The first objection is that such a pro-organics view is mistaken about the most important empirical facts. In particular, although it is true that organics may be better for the environment than conventionals in some locations and with respect to some food products, and although it may be generally true that organic methods produce less environmental harms per cultivated acre, nonetheless experts often argued that all-things-considered organics are generally worse for the environment than conventionals because organics have lower yields (at least 20% to 25% lower, and even lower the closer one gets to the alleged ideal of permaculture[6]), and when the lower yields per cultivated acre are taken into account, arguably it is generally true that organic methods produce more environmental harms of most kinds per unit of product than conventional methods—which, according to this objection, should surely be the relevant measure of whether organics are better for the environment than conventionals, since doing worse by that metric means doing more total harm for any given level of total food output.[7] This is possible because the lower yields of organics imply that shifting toward organics means increasing the amount of the Earth's land that must be devoted to agriculture, which is bad for the environment in myriad ways—from destruction of ecosystems and loss of biodiversity as a result of increased land use, to turning carbon sinks into sources of carbon emissions, and many others.[8]

Furthermore, some studies argue that, in addition to being generally no better for the environment, organics are also generally no better for human consumers than conventionals. Organics are allegedly no more nutritious than conventionals (with exceptions in some locations with respect to some particular products), and organics arguably do not help avoid pesticide levels that have been found to be a threat to human health (with exceptions in some locations with respect to some particular products). The argument for this claim is that overall pesticide residues found in foods are at levels below the tolerances set by
p. 72 science-based analyses).[9] ↳

The second main objection to the pro-organics view is that even if such a pro-organics view were not mistaken about the empirical facts about yields and environmental impacts, it would still be mistaken as an answer to the question of what we should do because it mistakenly assumes that we have no important goals beyond simply minimizing our footprint on the environment. But, on the contrary, we have a number of additional goals that are arguably much more important—for example, we have the goal of feeding the entire world—not merely feeding wealthy people who can afford to shop at farmers' markets and the like. This leads to a serious problem for the pro-organics response because if we shifted heavily toward organic methods of farming, it appears that we would not have nearly enough food to feed the world by mid-century. Given the world's growing population and growing affluence, there will be a growing demand for meat, as well as a growing demand for renewable energy, which is provided in part by biofuels that subtract from the agricultural output available as food. For example, a widely defended prediction based on modeling these dynamics is that we will need to nearly double crop production by 2050 over 2010 levels, even without overly pessimistic assumptions about biofuel use (which have the potential to increase future demand even further).[10]

The problem of feeding the world is only made worse by climate change, which according to one leading study has already reduced average global yields of corn and wheat production by 3.8% and 5.5%,

respectively, since 1980 relative to what they would have been without human-caused climate change.[11] And the authoritative United Nations Intergovernmental Panel on Climate Change (IPCC) predicts that average global yields will continue to decline by up to 2% per decade for the rest of the century if we do not reduce our emissions from their current "business as usual" trajectory. According to the IPCC, business as usual will pose a "significant risk to food security even with adaptation."[12] And the other side of the coin in
p. 73 connection with climate ↳ change is arguably even worse for the poor this century: if we were to quickly reduce emissions to levels that properly reflect the social cost of carbon emissions, models predict that this would increase food prices even more in the coming decades by increasing the cost of food production and reducing land devoted to agriculture, especially if this is allowed to create a vast increase in diversion of crops for use in biofuels to reach this level of mitigation.[13]

So, arguments for the pro-organics view face important objections about their empirical assumptions (namely, that the argument mistakenly assumes that organics would be better along both environmental and other dimensions), and objections to their normative assumptions (namely, that the argument mistakenly assumes that producing enough food to feed the world is not an important dimension of value).

The Pro-Organics View and Connections to Philosophical Debates about Ideal versus Nonideal Theory and Global Justice

Defenders of the pro-organics view rarely consider these objections. But when they do, many on the pro-organics side insist that such objections assume that too many regrettable aspects of our current world are unchangeable, including regrettable facts about increasing consumption of meat, regrettable facts about climate change, and perhaps also other regrettable background facts such as the use of biofuels and the general background of the congressional-agribusiness-industrial complex. Instead of taking these things as fixed, many on the pro-organics side insist that the only sustainable way forward is to turn away dramatically from these aspects of the status quo: in particular, they insist that we must combat climate
p. 74 change effectively, reduce human population,[14] and ↳ perhaps also reduce our consumption of meat, which would then allow us to feed the world via organic farming methods. Furthermore, this would make the world's human population healthier on average and would also allow the resources used in animal agriculture to be used for other more productive purposes.

Along these lines, it could be argued that a world with dramatically reduced meat consumption and global organic agriculture is a key part of the outcome that is ideally best for the world because it represents the food system that is part of the best possible outcome for humanity given the basic physical constraints of our world. So, instead of resigning ourselves to complicity in the current regrettable system, it could be argued that we should instead aim for this ideally best outcome, which would be much better along every ethically important dimension.

But even if we agreed that the ideally best outcome would involve organics heavily in this way, many would insist that nothing immediately follows about what policies we should actually promote. In particular, even if we agree that the ideally best outcome would involve the conjunction of (a) dramatically reducing people's appetite for meat, (b) dramatically reducing people's appetite for fossil fuels, and (c) moving our agricultural production heavily toward organics, nonetheless it does not follow that we should actually try to bring about (a), (b), and (c). That is because the predictable effect of a policy portfolio that aims for (a), (b), and (c) is arguably that we will fail to succeed in bringing about both (a) and (b), and so insofar as we do succeed in bringing about (c), that will lead to starvation of the world's poor while the rich continue to eat meat, as well as increased use of land for agriculture, and thus destruction of ecosystems and an even worse outcome for humans and nonhuman animals with respect to climate change. As a result, adopting such a portfolio of policies does not seem to be what we should actually do, even if we agree that it aims most

directly at the ideally best outcome. Many who disagree with the pro-organics view take this to show that even if we agree that a heavy shift to organics would be part of the outcome that is ideally best, nonetheless we should not favor a heavy shift to organics, at least not over the next fifty years during which the challenge of feeding the world will come to a head.[15]

As this example shows, assuming that conclusions about what policies to promote follow directly from the facts about what would be ideally best is to be idealistic in a way that can be tragic, since it threatens to lead to catastrophic outcomes for humanity and the rest of the natural world. If it is indeed foreseeable that a pro-organics approach to policymaking would have these downsides with no realistic upside, such
p. 75 policymaking would then be an example of *counterproductive idealism*, in which well-intentioned ↳ idealism is paired with a lack of serious concern for the empirical facts of the nonideal real world in a way that ensures that policymaking fails to do nearly as much good as could have been done—and at worst is catastrophically counterproductive. With this in mind, it is easy to see how an intention to engage in effective altruism could actually result in counterproductive idealism if the interventions depend on a misapprehension of the relevant empirical facts.[16]

To translate these considerations into philosophical terms, many pro-organics arguments can be interpreted as answering *ideal theory* questions regarding what should be done *conditional on everyone acting in an individually ethically optimal way*; however, food policy requires us to answer *nonideal theory* questions regarding what should actually be done regarding food systems *given the actual suboptimal dispositions of the world's people (and suboptimal existing institutions, etc.)*. Even if we assume that the pro-organics view is correct about what we should do in ideal theory, it not clear that anything similar follows about what policy we should actually promote.

In response to these objections based on a concern for feeding the world's poor, many on the pro-organics side are inclined to dismiss the problem of feeding the world as "not our problem" on the grounds that it is irrelevant to decisions about what food system we should promote. Instead, many on the pro-organics side are inclined to see the question of what food system we should promote as a question about what is best for us, where "us" is understood as referring to the members of our very local community or foodshed. This implicitly makes the plight of those outside our foodshed irrelevant to what we should do.

But when we critically examine this pro-organics response, it can seem problematic because in order for the empirical facts about the amount of food needed to feed the world to really be irrelevant in the way that this pro-organics response assumes, the pro-organics view must ultimately insist that even if billions would starve, that would still provide insufficient reason to grow more food by more intensive means, even if this would make our way of life and satisfaction of our environmental values within our local foodsheds in the developed world only somewhat worse.

To make a connection to the literature on global justice, it is important to see that this pro-organics response is thus analogous to very strong statist responses to the idea that citizens of rich nations must take steps to aid the citizens of poor nations: the strongest statists simply deny that we have such obligations and adopt the stance that the plight of the world's poor does not give us sufficient reason to reprioritize our own domestic concerns.[17] The pro-organics view under discussion here can be seen as an instance of this strong statist view: if our domestic concern is to have tastier vegetables and marginally cleaner water, and achieving that goal would mean that billions of poor people starved abroad, then so much the worse for
p. 76 those billions of poor people ↳ who had the misfortune of "losing the lottery of birth" and being born into a different society.

If this characterization of the dialectic seems too dramatic, it is worth noting that many of the world's foremost experts agree that the pro-organics view is mistaken for exactly these simple and dramatic reasons. For example, Norman Borlaug, recipient of the Nobel Peace Prize and to some the most respected

food-systems humanitarian of all time, claims that "we aren't going to feed 6 billion people with organic fertilizer. If we tried to do it, we would level most of our forest and many of those lands would be productive only for a short period of time."[18] And chemist John Emsley writes that "the greatest catastrophe that the human race could face this century is not global warming but a global conversion to 'organic farming'—an estimated two billion people would perish."[19]

So the stakes are high in the debate over the pro-organics view. Much is at stake for the world, especially the global poor, depending on what set of values is correct (strong statism or a more cosmopolitan alternative concerned fundamentally with overall global welfare? deep ecology or a more (anthropocentric?) utilitarian alternative?) and what the relevant empirical facts are about the consequences of a shift to organic agriculture—which, even if it were confined to the United States, could arguably have disastrous effects on food prices for the global poor.

Upon careful reflection, many people would presumably agree that we, the citizens of rich nations, should be willing to make at least some sacrifices of our environment via our food-systems policies if that is the only way of ensuring that the global poor are able to be properly nourished. This conclusion is especially difficult to resist if the impermissible actions of our society are also the primary cause of the food insecurity of the global poor (which will be increasingly true over time due to climate change—note the analogy here to Thomas Pogge's arguments regarding global poverty, which argue that members of our society have a special obligation to help the global poor because we are causing their continued oppression) and if we are most fundamentally all members of one global society in a way that implies that we have standard obligations of distributive justice to the global poor (as, e.g., Charles Beitz and others have argued).[20] This suggests that there are questions about global justice and what food system we should have that are structurally similar to, but go far beyond, the question of whether we should merely contribute financial support to food aid programs for the global poor. Taking these additional challenges seriously leads to
p. 77 important objections to the Standard Argument for the pro-organics view.[21] ↳

Food Sovereignty, the Pro-Organics View, and Global Justice

The pro-organics view is sometimes (but not always) conjoined with arguments in favor of *food sovereignty*, which is roughly the view that not only should food be both produced and consumed in local foodsheds (as many versions of the pro-organic view maintain), but that local populations should also own and control these local food systems. This view rejects the status quo of a globalized food system with enormous power exercised by multinational corporations, along with the underlying so-called "neoliberal global order" and its imposition of institutions of so-called "free trade".[22]

As many critics agree, institutions of global trade actually fall far short of the ideal of free trade and often involve trading rules that are unfair to the global poor and serve to shift power away from the global poor and subsistence farmers and to large corporations and their shareholders in developed nations.[23] What distinguishes the food sovereignty view from more mainstream critiques of the actual international trade regime (as that regime is actually realized by global trade institutions such as the WTO and its agreement on agriculture)—for example, mainstream criticism of those institutions from Nobel Laureates Joseph Stiglitz and Angus Deaton—is that the food sovereignty movement also rejects the basic goals of free trade (unlike mainstream critics) and instead prioritizes local control and decision-making over the consequences for well-being.[24]

As such, the food sovereignty view fits naturally with the values that are endorsed by many proponents of the pro-organics view in its prioritization of local values over global welfare, which imply a strong statist view on issues of global justice (which is not to say that these values imply that government should be the primary determinant of food systems, as opposed to the local people themselves). This appears to be the

p. 78 common normative ↳ foundation of both views despite the fact that defenders of those views rarely explicitly theorize the normative foundation for their views. Once this becomes clear, it is less surprising that there is a strong correlation between food-system commentators who defend the pro-organics view and those who defend the food sovereignty view.

This also clarifies the structure of numerous possible objections to the food sovereignty view: many cosmopolitans will reject the prioritization of local community power over global well-being. And even beyond that basic issue, it may seem that the food sovereignty view prioritizes local ownership and control over the well-being of even those local people in a way that is unmotivated and implausible: Should a society's own people remain starving and in poverty rather than cede some control to outsiders? Is it really better to stop trading with the developing world and thereby stunt their development in order to ensure that everything that affects them is entirely their own making?[25] How are the values behind food sovereignty different than the protectionist values partially responsible for Brexit and the election of Donald Trump? Might defenders of food sovereignty be attracted to a reply based on nonideal theory: that while free trade is best in ideal theory given that it would then be combined with redistribution to protect the poor and others left behind by globalization, in actuality we should not support free trade because those protective transfers will predictably not be made in the nonideal real world?[26] These questions dovetail with more general questions about social policy, the legitimacy and desirability of international institutions, and the "democratic deficit" that arguably exists whereby global elites or at least rich nations control most of these institutions[27]—which, consistent with that criticism, might also arguably be the best feasible institutions for promoting geopolitical stability and global well-being.[28]

In response, defenders of food sovereignty are apt to insist that free trade does not in fact promote well-being better than food sovereignty would, and so there is in fact no tension between their view and well-being in the real world. However, most advocates for food sovereignty do not focus on analyzing the well-being-based arguments for global free trade made by leading economists, and instead focus their rejection of trade institutions on the basis of other values described here—which is the basis for the interpretation of
p. 79 the view here as prioritizing local control and decision-making over the ↳ consequences for well-being. As this should make clear, the characterization of food sovereignty here is likely to be contested by many of its proponents, just as they contest much of the discourse from those who focus on producing enough food to feed the world.

At the same time, it is striking that proponents of food sovereignty rarely engage with many of these objections and questions about the normative foundation of their view, just as it is striking that defenders of the pro-organics view rarely engage with objections based on feeding the world. To move both debates forward, more explicit engagement is needed with the normative and empirical objections raised here, and with the normative literature on social philosophy and global justice.

Sustainability, Optimality, and Trade-Offs

One important consideration highlighted by the preceding discussion is that feeding future people is arguably one of the most important objectives we should try to achieve, and arguably we should be willing to make trade-offs along other dimensions that are also of value—such as promoting a clean and flourishing environment—in order to achieve the objective of properly nourishing people. This sets the stage in this section for evaluation of arguments that unless we adopt organic agriculture we will be making unsustainable use of the world's resources.

On analogy with the preceding discussion, two important things to consider in response to such an argument are that even if we agree that we are making unsustainable use of resources in some important sense, it does not necessarily follow that we should stop doing so. First of all, trying to move in the direction

of ideal sustainability might have the perverse consequence of making things even worse given known nonideal background facts. Second, even if we successfully made progress along a dimension of sustainability (such as sustainable use of groundwater and soil), this might make our broader, more important goals (such as feeding the world and ultimately promoting, say, well-being) less well achieved than they would be by making sacrifices of sustainability. In other words, it may be better to trade off sustainability for other things that matter more.

These questions are particularly pressing for arguments that assume our objective should be to secure sustainability along some particular dimension. For example, in the context of the discussion of organic versus conventional agriculture, although it is possible (but empirically contentious) that shifting heavily to organics would achieve the narrow environmental gains of cleaner water supplies and richer soil, nonetheless if we care more about the broader goals of human welfare and the overall health of the natural world, and if we are beyond the threshold at which narrow environmental gains like improved soil and water can only be purchased at serious cost to our broader goals of human well-being or the overall health
p. 80 of the natural world (because of the urgent need ↳ to feed the planet and prevent much more land from being converted to agriculture), then arguably we should not do what would be best along the narrow environmental dimensions of soil and water quality; instead, we should be willing to sacrifice those things —we should trade them off—for broader gains that are more important because making those environmental trade-offs is the best way to promote what ultimately matters most.

To dive deeper into the notion of sustainability, note that what we are interested in when we deploy this concept is whether the type of actions we are performing can be sustained into the future—if so, they are sustainable; if not, they are unsustainable. But what is the relevant action type for us to focus on in answering this question? To begin to illustrate the issues here, note that a very specific action, such as my consuming this particular peanut, is unsustainable in one sense because if I consume this very peanut, I will not be able to consume this very peanut again and again into the future. But we are not concerned with the sustainability of token actions in this way when we deploy the concept of sustainability. Instead, we are apt to think that what really matters is something more like whether continued similar acts of consumption by everyone are perfectly consistent with the continued availability of peanuts, or at least are consistent with continued acts of similar consumption of similar goods into the future. However, the disjunction in this platitude reflects an important ambiguity that remains between three different senses of sustainability that are often discussed in the literature, with important disagreement among commentators about which should be our focus.

The first of these competing definitions of sustainability is: whether our use of a particular natural resource *x* is beyond the (possible) replenishment rate for *x*; if it is beyond the replenishment rate, we will not be able to continue consuming *x* at this rate into the future, and so our consumption of *x* is unsustainable in one clear sense. However, it seems unlikely that it is always wrong to use a particular resource beyond its replenishment rate—instead, unsustainability in this sense is more like a "warning indicator" that should cause us to carefully evaluate if our use of the resource is warranted, but with the recognition that it might well be warranted. For example, consider a particular resource for which substitutes will be available in the future (historically, our use of oil was a frequently discussed example): it appears that using such a resource beyond its replenishment rate might be perfectly appropriate, with the thought that we will simply substitute other resources insofar as that resource becomes overly scarce.[29] From this perspective, a second notion of sustainability is likely to seem more important: whether our use of a general type of resource is beyond the (possible) replenishment rate for that type of resource, where in the literature the relevant "type" of resource is most frequently taken to be the very general type *natural capital*—roughly, the sum of all natural resources that are of value. From this perspective, use of one resource (such as oil) beyond the
p. 81 replenishment rate might be unobjectionable if it does not threaten our ability to continue ↳ using natural

resources at a similar or greater rate into the future (with perhaps other resources being used as substitutes where desirable).

Deep ecologists and others who would prioritize ecosystems over humans might reject reliance on this second notion of sustainability, and might argue instead for a version of sustainability in the first sense as a genuine constraint on permissible use of ecosystems: namely, we should not use anything in any ecosystem beyond the rate at which it can be replenished in order *to maintain ecologically optimal levels in that ecosystem*.[30] In contrast, those who self-identify as "ecological economists" often argue that our objective should be sustainability in the second sense: to ensure that our consumption of natural capital in general is sustainable—this sort of view is known as *strong sustainability*.[31]

Finally, those who self-identify as more "mainstream" or "environmental economists" tend to reject the idea that strong sustainability is a genuine constraint, and instead defend the importance of only a third notion of sustainability: whether our consumption in general is sustainable, even if it involves consumption of natural capital at levels that themselves cannot be sustained. The idea behind this third idea—often called *weak sustainability*—is that what ultimately matters is whether our ultimate goals themselves can be sustainably achieved. From one mainstream economic perspective, the answer to questions about sustainability in this sense depend on whether (growth rates of) (per capita) consumption can be sustained into the future as a function of technology, labor, and capital—where, crucially, technology and overall capital might increase even as natural capital decreases, partly because use of natural capital might lead to
p. 82 compensating gains in technology and social capital.[32] ↳

With this overview in hand, to illustrate how considerations of sustainability and food systems are more complex than they might initially appear, imagine a scenario in which we overharvest our communal fishery (in the sense of exploiting it beyond its replenishment rate), and we use some of the profits to build schools, which increases the education level of our population, thereby increasing technology and social capital, and also thereby decreasing the growth of our population. As a result, this decreases future demand for fish and other natural resources relative to a baseline with higher population growth. This illustrates the way in which it is possible that using one type of natural capital in a way that is unsustainable in some sense could yield returns that, first, decrease our long-run use of natural capital and could be the current-period part of an optimal inter-temporal pattern of use that maximizes the long-run value of natural capital. And even if we assume that it does not have those benefits for natural capital and instead diminishes our natural capital, mainstream economists will stress that using natural capital beyond its replenishment rate might still be optimal because it could be made sustainable in the short run only by sacrificing other things that are more important, such as increases in other factors of production and (most fundamentally) long-run human well-being (in this example illustrated by the sacrifice in education and human development that would be necessary to avoid reducing natural capital). Thus, our society's consumption might be sustainable in the sense of weak sustainability because it might not result in the reductions in the overall levels of technology or capital, even if it is not sustainable in the sense of strong sustainability because it involves reductions in natural capital. According to mainstream economists, the key is that natural capital is only one among many kinds of assets that can be used to generate well-being—and so if natural capital can be converted into other kinds of assets that can be used to generate well-being at a greater rate, then the best thing to do can be to make ourselves poorer with respect to natural capital by using it beyond its replenishment rate, in order to secure greater benefits overall.[33]

The upshot of all of this in the food domain is that it is possible that degrading groundwater, soil, and so on in the short run might be the best way for us to use those resources because it is possible that optimal use might involve some amount of accumulating pollution and degradation over the coming decades until population growth stabilizes, the world becomes richer, and other more pressing threats to global welfare are brought under control, and environmental problems subside.[34] According to defenders of weak sustainability, the more general theoretical conclusion to draw is that when we consider arguments that

p. 83 invoke the notion of sustainability, what ultimately matters is not ↳ whether our current usage is sustainable in the sense that it does not exceed a replenishment rate, but rather whether our current use is part of an overall inter-temporal pattern of resource use that avoids dooming any future generation to a worse life than they would have had if we consumed less.

Whether one favors strong or weak sustainability, in either case it is no surprise that a serious analysis of sustainability in the context of our modern globally interconnected society often requires an inter-temporal global integrated assessment. But such an assessment also allows us to ask whether a course of action is optimal, at least insofar as we are prepared to add assumptions about how to correctly make trade-offs between the things that ultimately matter, as must typically be included in assessments of weak sustainability.

This leads to a big-picture question and reason to doubt that our ultimate focus should be on the concept of sustainability: if we are going to make such an assessment, and if we can also use it to answer questions of optimality, why should we care nearly as much or at all about the answers it gives to questions of sustainability? To illustrate this question, consider a toy example in which well-being is provided by eating the fruit from a tree that grows next to a complementary plant, where the tree will continue to grow and bear more and more fruit as long as we do not destroy the complementary plant. So, imagine that our well-being has grown over generations, and so we are now at a point where we clearly have met all of our most basic needs—which is consistent with our not having everything required for a perfect life, and so future generations can continue to be better off if the tree continues to grow. But now imagine that our generation decides to cut down the complementary plant because by eating its bark our generation can become ever so slightly better off ourselves. This slight benefit for ourselves comes at the expense of future generations because our cutting down the complementary plant ensures that instead of having the ability to continue enjoying increases in their well-being by continuing to eat more and more fruit from the tree, future generations are doomed to the same level of well-being for all time that we enjoy. Nonetheless, our cutting down the complementary plant might be classified as sustainable use, because it does not compromise the ability of future generations to meet their own needs and need not reduce well-being or capital in the future. However, it seems clear that our destroying this plant, merely to benefit ourselves in a trivial way, which if it continued to exist would create incredible riches for future generations, is not an ethically justifiable use of its resources—it is far from ethically optimal, and what is optimal seems to be what really matters for deciding what we should do.

One might even take this case to be a counterexample to some leading conceptions of strong and weak sustainability, on the grounds that our action of cutting down the plant does not satisfy the core intuitive notion of sustainability, even though those definitions imply that it is sustainable. To see how this generates a purported counterexample to strong sustainability, imagine that the overall effect of cutting down the complementary plant is to freeze overall natural capital at current levels for all future time. Similarly, if sustainability is understood in terms of the ability to sustain a level of growth of well-being, we can imagine
p. 84 that the rate of growth is increasing, but cutting down the ↳ complementary plant freezes growth for all time at the current level. On any of these interpretations, it seems that cutting down the tree is not permissible; it may also seem that the act of cutting down the plant does not satisfy the core intuitive notion of sustainability, even though some definitions imply that it is sustainable action.

The general upshot of this discussion of sustainability is that while notions of sustainability are generally useful as "warning indicators," and might be somewhat reliably correlated with impermissible action as one moves farther from the mere replenishment sense and closer to the sense of weak sustainability, nonetheless what ultimately matters is arguably optimality, and the assessments we need to calculate weak sustainability also typically provide the modeling resources we need to assess optimality.[35] So, arguably our main focus should be on optimality and not sustainability—and this is especially true from a philosophical point of view.

Sustainable Intensification and the Goal of Optimal Global Food Systems Given Realistic Constraints on Policy

With the desirability of identifying the optimal feasible path forward—that is, the inter-temporal course of action open to us in our nonideal world that maximizes what ultimately matters to us most, and thus makes the intra- and inter-temporal trade-offs that we have to make in the best way possible—and the methodology of integrated assessment as a modeling tool for trying to identify the optimal path, we are now in a good position to describe the widespread defense in food-systems science of a view called *sustainable intensification* in agriculture, which aims to identify the optimal feasible path forward in the domain of food, ideally using global integrated assessment. In light of many of the considerations already discussed, the optimal path appears to lie somewhere between the undesirable extremes of, on the one hand, contemporary industrial agriculture and, on the other hand, a move heavily toward organics.

At the highest level of abstraction, sustainable intensification is doing whatever is best in the realm of agriculture in our nonideal world to ensure that our ultimate goals are best achieved over the long run. To a very rough first approximation, in practice this is often taken to imply that we must produce enough food to meet demand in a cost-effective way without increasing the amount of the Earth devoted to agriculture, and
p. 85 (subject to that constraint) minimize the environmental impacts of so doing. ↳

In somewhat more detail, given what is known about the relevant empirical issues, sustainable intensification will require a highly diverse array of initiatives that will display substantial variation from region to region and from context to context, depending on facts about the people, cultures, and technology involved as well as facts about the physical landscape. And although it may be best in some locations and with respect to some crops to use almost all of the methods of contemporary industrial agriculture, it will by no means be best generally to use all of those methods. Of particular note, the frequent overuse of soil, groundwater, and chemicals in contemporary industrial agriculture can often be avoided by technologically feasible alternative practices, and in some locations—often when subsistence farming is the norm—highly organic methods are best.[36]

Beyond these general statements, there is no precise agreement about the exact implications of sustainable intensification as a "middle way" between the status quo of contemporary industrial agriculture and a move heavily toward organics, mainly because the empirical and normative questions that must be answered are very difficult—as they often are in connection with highly complex questions about what we should do about the world's thorniest problems. Climate change is a good analogy because there is no precise agreement about the exact details of what emissions-reduction path would be the best response to the problem we have created, even though there is agreement in outline that such reductions must be made. For example, regarding sustainable intensification, one group of distinguished commentators writes:

> In one sense the answer is simple: crop and livestock production must increase without an increase in the negative environmental impacts associated with agriculture, which means large increases in the efficiency of nitrogen, phosphorus and water use, and integrated pest management that minimizes the need for toxic pesticides. In reality, achieving such a scenario represents one of the greatest scientific challenges facing humankind because of the trade-offs among competing economic and environmental goals, and inadequate knowledge of the key biological, biogeochemical and ecological processes.[37]

Nonetheless, there is significant agreement that the best way forward will often require (investments in) private and social entrepreneurship, education, access to information, decentralized decision-making and collective action by farmers rather than central planning, heavy use of technology beyond improved seed varieties (such as more efficient irrigation-, pesticide-, and fertilizer-application technology), where it is

more controversial but often argued that individual farmers should also often own and control the instances of this technology that they use, as well as having ownership and control over their land, along with
p. 86 continued but more efficient use of synthetic fertilizers and ↳ pesticides in very many locations (when better organic forms are not easily available), in combination with more traditional conservation agriculture techniques (e.g., no-till farming, planting cover crops, rotating crops), use of salt water for irrigation in some areas, and so on.[38] In addition to these initiatives on farms, it generally agreed that it would also be beneficial to make large increases in investment in research and development of basic agricultural technology. In developed nations, it would be ideal to eliminate farm subsidies and to increase market-based regulation to force producers and consumers to pay for the real costs of their actions—but progress along these latter two fronts may be politically infeasible, and so a preferable second-best approach might be to settle for an increase in more inefficient forms of command and control regulation.[39] Furthermore, we need to promote other large-scale background policies and institutions in and beyond the domain of food, such as promoting the best global climate policy that is politically feasible and investing in climate adaptation to avoid yield loss for many staple crops due to climate change, as well as further investment in basic background institutions that promote law, order, sustainable development, and the capacity for redistributive transfers for those who are vulnerable or who would otherwise be unjustifiably adversely effected by policy.[40]

Beyond general agreement on these issues, sustainable intensification is more of a framework for how to answer the big-picture question of what agricultural system we should aim for, rather than a detailed substantive theory of what the answer is, because sustainable intensification is consistent with many different substantive answers to that question that are inconsistent with each other. For example, many proponents of the framework believe we must put more emphasis on the selective use and further
p. 87 development of the tools of industrial agriculture (such as GMOs or more precise application ↳ technologies for irrigation, pesticides, and fertilizer), while many other experts believe that we must instead put more emphasis on agroecological intensification to meet these goals, which includes more tools from organic agriculture such as intercropping (growing two or more crops simultaneously, in a way that allows the crops to complement each other in numerous ways, such as providing nutrients for each other, and providing pest resistance), rotation (growing multiple crops in sequence for similar reasons), agroforestry (growing perennials and annuals together for similar reasons), green manuring (using legumes and other plants as nitrogen fertilizers for soil rather than animal manure), conservation tillage (planting seed directly into the soil rather than tilling it first), and pest control that utilizes natural process whenever possible and at least does not degrade the soil.[41] As a result, the former group sees much more of a role for the tools of industrial agriculture in feeding the world, while the latter group sees much more of a role for the tools of organic agriculture, both under the banner of sustainable intensification. But it is crucial to note that most advocates of sustainable intensification see some important role for the tools of both approaches.

One worry about sustainable intensification is that for all of its attractive features, the framework may predictably lead to the neglect of some ethically important values if it is used to guide policy. Perhaps most worrisome, arguably it may lead to neglect of the need to reduce food waste or animal consumption, and to neglect of animal welfare in general. That is because a focus only on increasing yields while reducing environmental impacts does not clearly highlight the vast amounts of food waste in the food system (the reduction of which may be part of the best way forward), nor does it address the consumption of animal products, which is arguably largely unnecessary in developed nations and the primary cause of many agricultural challenges. It may also appear to tell in favor of industrial animal agriculture with all of its problematic animal welfare implications, since intensive methods of animal agriculture are arguably the best way of meeting global demand for animal products while minimizing environmental impacts of any given realistic level of global animal product production.[42]

A focus on sustainable intensification arguably may also lead to neglect of fairness considerations, and insufficient attention to whether there are fair opportunities and benefits for the world's poorest farmers. This is because a focus only on increasing yields while reducing environmental impacts appears to tell in favor of whatever agricultural system best meets those objectives, which may be one that makes things even worse for the world's poorest farmers. As some historical evidence that a worry along these lines is important to consider, Gordon Conway argues that the last concerted effort leading to large-scale global
p. 88 increase in yields—the Green Revolution of the 1950s, 1960s, and ↳ 1970s often associated with the work of agronomists and development researchers such as Norman Borlaug—had the result that "larger landowners have reaped most of the benefits, while the poor and landless have missed out."[43] More generally, some activists and scholars would argue that sustainable intensification fails to acknowledge the problems with the current neoliberal global order, and even shores up the ideology behind neoliberalism.

Pro-Vegan Arguments and Empirical and Normative Objections

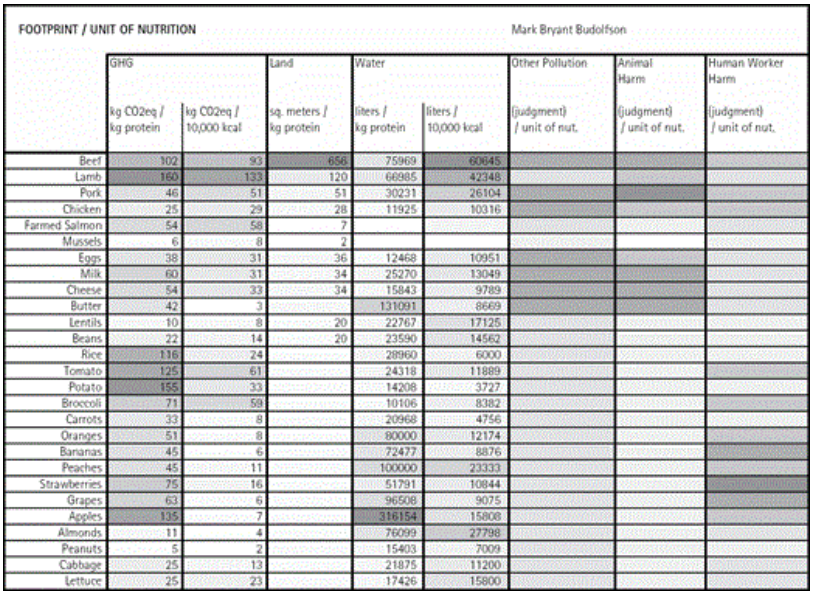
Recall the observation at the beginning of this essay that the harm footprint of an average meal in developed nations is equivalent to dumping thousands of gallons of water down the drain, dumping pollutants into our rivers, killing the creatures that inhabit our ecosystems, and harming other human beings. This point is familiar to those who have studied the environmental harms associated with intensive animal agriculture, which have been extensively documented elsewhere and will not be rehearsed here.[44] Partly in response to these facts, many philosophers believe we should promote a vegan food system, based on a belief in the empirical premise that a vegan food system minimizes harm along all of the dimensions we should care about and would also allow us to feed the world most easily by eliminating the inefficient use of crops to feed animals.

However, what is less familiar to philosophers is that harms of a similar magnitude are associated with many vegan meals—such as a familiar vegan meal that combines pasta, quinoa, greens, avocados, berries, fruit, and nuts. The explanation is that contemporary agriculture is surprisingly intensive in terms of the land, water, chemical fertilizers, pesticides, fossil fuels, migrant labor, and other inputs that it requires, where that intensity—even in the production of vegan staples—causes serious harms to humans, nonhuman animals, and other aspects of nature. Furthermore, even some vegan staples tend to be delivered via supply chains in which harm, enslavement, and even murder of those who produce those goods is a common occurrence due to the predatory acts of the criminal gangs that control those supply chains.[45] And
p. 89 there are also a host of ↳ other potential harms that may lie behind even a vegan meal—as one recurring example, demand from developed nations for a particular vegan staple might harm humans in lesser developed nations by pricing their hungry citizens out of the market for that nutritious staple, as has allegedly happened with some staples (such as quinoa, although the facts in that case are contested), and other commodities such as corn that are also used in biofuel production.[46]

In response, pro-vegan philosophers are apt to assume that the harm footprint of vegan staples is nonetheless better along every dimension than the harm footprint of animal products. If this were correct, then the empirical premise behind the pro-vegan Standard Argument would still be true.

However, when experts quantify the harms of vegan versus animal staples, the results suggest that the truth is far more complicated than the pro-vegan argument assumes: in a substantial number of cases, vegan staples have a worse harm footprint than some animal products along some dimensions. As a result, it appears that we should reject the idea that being a nutritious vegan food system is anywhere near sufficient for being an optimal food system. To summarize some of the relevant empirical evidence, consider the chart in figure 4.1, which is based on numerical estimates of the main kinds of harms that lie behind many kinds
p. 90 of food.[47] ↳

Figure 4.1



FOOTPRINT / UNIT OF NUTRITION — Mark Bryant Budolfson

	GHG		Land	Water		Other Pollution	Animal Harm	Human Worker Harm
	kg CO2eq / kg protein	kg CO2eq / 10,000 kcal	sq. meters / kg protein	liters / kg protein	liters / 10,000 kcal	(judgment) / unit of nut.	(judgment) / unit of nut.	(judgment) / unit of nut.
Beef	102	93	656	75969	60645			
Lamb	160	133	120	66985	42348			
Pork	46	51	51	30231	26104			
Chicken	25	29	28	11925	10316			
Farmed Salmon	54	58	7					
Mussels	6	8	2					
Eggs	38	31	36	12468	10951			
Milk	60	31	34	25270	13049			
Cheese	54	33	34	15843	9789			
Butter	42	3		131091	8669			
Lentils	10	8	20	22767	17125			
Beans	22	14	20	23590	14562			
Rice	136	24		28960	6000			
Tomato	125	61		24318	11889			
Potato	155	33		14208	3727			
Broccoli	71	58		10106	8382			
Carrots	33	8		20968	4756			
Oranges	51	8		80000	12174			
Bananas	45	6		72477	8876			
Peaches	45	11		100000	23333			
Strawberries	75	16		51791	10844			
Grapes	63	6		96508	9075			
Apples	135	7		316154	15808			
Almonds	11	4		76099	27798			
Peanuts	5	2		15403	7009			
Cabbage	25	13		21875	11200			
Lettuce	25	23		17426	15800			

Footprints per unit of nutrition for various foods, based on global or national averages.

p. 91 This chart expresses the harm footprints of various kinds of food in terms of their footprint per unit of nutrition, which paints a much more accurate picture than the presentations favored by pro-vegan sources in terms of footprint per unit of product, because animal products contain much more nutrition per unit of product than vegan alternatives, and so a presentation of footprints by product weight introduces a highly misleading pro-vegan bias.[48]

One upshot is that based on regularities in the harms that lie behind the foods we eat, it appears that we can do much better than simply promoting vegan food systems. Instead, we should consider how to optimize the portfolio of crops that we produce to allow us to meet demand and provide excellent nutrition, and otherwise minimize the overall harm footprint of our food system which promoting our other ultimate goals. As the chart makes clear, even given vegan values, it appears that the optimal portfolio will involve being willing to make some trade-offs in order to avoid larger harms along other dimensions.

In fact, even given vegan values, it is not clear that a vegan food system will ultimately be superior to a non-vegan food system. For example, even if our only goal was to minimize the animal harm footprint of our food system (and so we did not care at all about human harm, environmental harm, or other kinds of harm), nonetheless vegan staples generally have a worse animal harm footprint than some specific animal products such as mussels (as the chart indicates) because many vegan staples have substantial land and water footprints, which means that they take away land and water from wildlife, which harms those animals. In contrast, mussels have essentially no animal harm footprint at all—partly because mussels are not conscious and so harvesting them does not involve animal harm that has any important weight, and partly because the land and water footprint of mussels is very small, and much lower than many vegan staples.[49]

In addition to this kind of worry about the empirical assumptions of pro-vegan arguments, there is also room for an objection to pro-vegan arguments based on the distinction between ideal and nonideal theory. The objection is that even if it is true that the ideally best food system is a particular vegan food system (namely, a very particular vegan system carefully tailored in light of the sort of evidence summarized in the
p. 92 chart), ↳ it does not follow that this is the food system we should actually tailor our policy to because in the nonideal real world we will predictably fail to succeed in eliminating people's appetite for meat, and so the fact that many people will continue to eat meat needs to be taken into account by our actual food-system

FOOTPRINT / UNIT OF NUTRITION

Mark Bryant Budolfson

	Greenhouse Gas		Land	Water		Other Pollution	Animal Harm	Human Worker Harm
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Beef	102	93	656	75969	60645			
Lamb	160	133	120	66985	42348			
Pork	46	51	51	30231	26104			
Chicken	25	29	28	11925	10316			
Farmed Salmon	54	58	7					
Mussels	6	8	2					
Eggs	38	31	36	12468	10951			
Milk	60	31	34	25270	13049			
Cheese	54	33	34	15843	9789			
Butter	42	3		131091	8669			
Lentils	10	8	20	22767	17125			
Beans	22	14	20	23590	14562			
Rice	116	24		28960	6000			
Tomato	125	61		24318	11889			
Potato	155	33		14208	3727			
Broccoli	71	59		10106	8382			
Carrots	33	8		20968	4756			
Oranges	51	8		80000	12174			
Bananas	45	6		72477	8876			
Peaches	45	11		100000	23333			
Strawberries	75	16		51791	10844			
Grapes	63	6		96508	9075			
Apples	135	7		316154	15808			
Almonds	11	4		76099	27798			
Peanuts	5	2		15403	7009			
Cabbage	25	13		21875	11200			
Lettuce	25	23		17426	15800			

policy. So, if there will predictably be some substantial demand for meat, then presumably our actual policy should use information such as that summarized in the chart to decide what specific non-vegan food system it is best in our nonideal world to promote with actual policy. (The facts in the chart also give rise to important objections to individual-level pro-vegan arguments about what individual consumers have reason to do, which I set aside here, but explore in a number of other papers.[50])

One familiar refrain that is confirmed by the evidence summarized in the chart is that it is worse to meet demand for meat with ruminants (e.g., cows) rather than non-ruminants along the specific dimension of climate-related harm. But beyond this basic observation, there are a number of further important questions that have an ethical dimension and are taken very seriously by many food-system scientists, but are ignored by philosophers who tend to focus on only ideal theory questions. For example, many experts argue that intensive animal agriculture generates less harm per unit produced than more "free-range" operations along some environmental dimensions, especially climate-related dimensions—and intensive operations also deliver nutrition at the lowest cost, and so keep prices down not only for animal products but also for other vegan commodities by minimizing the amount of feed required per unit of meat output.[51] At the same time, intensive operations typically have a higher animal-harm footprint. What is the correct way of making the trade-offs involved in this and other cases in our actual nonideal food-systems policymaking? And how should we take into proper account the benefits of animal agriculture to subsistence farmers in some locations in the developing world, which might not be well suited for alternative crops, and where owning large animals might confer other benefits, such as a more reliable form of money than any feasible alternatives?[52]

Prior to considering the issues discussed in this section, many philosophers are apt to criticize the sustainable intensification movement as taking increasing global consumption of animal products for granted, and not arguing strongly for a vegan food system. But, at this point, it is easy to see that
p. 93 sustainable intensification is focused on answering ↳ the nonideal theory question of what particular food system we should actually build policy around, and what food system we should promote given realistic constraints of feasibility. Sustainable intensification, with a substantial role for animal production, could be the correct answer to that question—which is arguably the most important question to answer—even if it is also true that a particular near-vegan system would be best in the highly counterfactual ideal scenario in which all individuals are disposed to act in a morally perfect way.

Conclusion

This essay has outlined a number of important objections to familiar arguments for organic and vegan food systems. First, the empirical premises of these arguments are called into question by the work of experts on the relevant empirical issues. Second, reflection on the relevant empirical facts also calls into question the assumption that there is a single food system that minimizes harms along each and every dimension that matters—instead, many experts would argue that the essence of the food-systems challenge is to decide what regrettable trade-offs it is best to make in food systems so that we can be salvage what matters overall—where the best overall food system is likely to be worse along some dimensions (including environmental harm) than some feasible alternatives. Finally, in order to answer questions about what food system we should promote with policy, it is arguably necessary to first take the perspective of the entire world and thus the global food system, and first answer questions such as: What global food system is best when everything is taken into proper account, including all of the global consequences for people and the environment of any local change we might make? And in light of this, how should rich and poor nations coordinate their efforts to achieve the optimal food system for the world, given the different capacities of nations, different levels of power in negotiations, and different levels of responsibility for the defects of the current system? What is our society's place in that optimal system? How exactly do these facts about the complex global system complicate the answer to these and other questions about what we should do in our society?

The progression of these questions—beginning with questions that can seem to have answers that depend only on easily known facts about our society and our local environment, but that ultimately require a complex global empirical and ethical integrated assessment that includes a proper accounting for values of global justice—is arguably the future of ethical debates about food and the environment, and is also representative of the arc of much of environmental ethics over the past century.

This essay has also explained why some food-science experts believe that a correct global assessment ultimately recommends what is called sustainable intensification of food systems, which involves more elements of contemporary industrial agriculture than are favored by proponents of organic or vegan alternatives. At the same time, this is not equivalent to the idea that sustainability should be our objective.
p. 94 Various leading ↳ conceptions of sustainability were considered, and none appear to capture the most fundamentally important objective for society.

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Notes

1 For a clear statement of deep ecology and this kind of idea, see Paul Watson, "Clarification of Where Director Paul Watson Stands on Some Issues," http://www.ecospherics.net/pages/wonw.htm . For a classic philosophical statement of deep ecology, see Arne Naess, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary," and for some representative criticism of philosophical views that give significant non-instrumental value to nature, see Elliott Sober, "Philosophical Problems for Environmentalism," both reprinted in *Environmental Ethics: What Really Matters, What Really Works*, 2d ed., ed. David Schmidtz and Elizabeth Willott (New York: Oxford University Press, 2012).

2 Note that this assumption does not involve the assumption that nature has only anthropocentric value. For an introduction to this issue, see "Introduction: The Last Man and the Search for Objective Value" in Schmidtz and Willott,

Environmental Ethics; and Richard Routley, "Is There a Need for a New, an Environmental, Ethic?" *Proceedings of the XVth World Congress of Philosophy*, Bulgaria, 1973. For a further overview of the literature on this and other leading issues in environmental ethics, see Andrew Brennan and Yeuk-Sze Lo, "Environmental Ethics," in the online *Stanford Encyclopedia of Philosophy* (2015), Claire Palmer, Katie McShane, Ronald Sandler, "Environmental Ethics," *Annual Review of Environment and Resources* (2014), and Dale Jamieson, "The Value of Nature", in his *Ethics and the Environment* (Cambridge: Cambridge University Press, 2008).

3 For leading examples of pro-organic arguments in public discourse, see Michael Pollan, *The Omnivore's Dilemma* (New York: Penguin, 2006); and Marion Nestle, *What to Eat* (New York: North Point Press, 2006).

4 Although it is not important to the argument here, as a conceptual point it is worth noting that contrary to the standard definition, "foodshed" cannot be defined as simply "the geographic region that actually produces food for a given population," because in the developed world this definition would imply that virtually the entire world is the foodshed for every population in the developed world (given the globalized food-distribution system)—which is contrary to the intended meaning of "foodshed" as it is commonly used. So, something like the definition offered here is needed to capture the intended meaning.

5 For example, the main argument of Pollan and Nestle can be understood as having the structure of the Standard Argument, as they seem to implicitly rely on the premise that organics are better along every dimension of value. For example, Nestle summarizes the case for organics as "when you choose organics, you are voting with your fork for a planet with fewer pesticides, richer soil, and cleaner water supplies" (66).

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7 H. L. Tuomisto et al., "Does Organic Farming Reduce Environmental Impacts? A Meta-analysis of European Research," *Journal of Environmental Management* 112 (2012): 309−320; K. Mondelaers et al., "A Meta-analysis of the Differences in Environmental Impacts between Organic and Conventional Farming," *British Food Journal* 111 (2009): 1098−1119; T. Fischer et al., "Crop Yields and Global Food Security," ACIAR, 2014.

8 Seufert et al., "Comparing the Yields of Organic and Conventional Agriculture"; Fischer et al., "Crop Yields and Global Food Security"; J. Burney et al., "Greenhouse Gas Mitigation by Agricultural Intensification," *Proceedings of the National Academy of Sciences* 107 (2010): 12052–12057; Norman Borlaug, "Feeding a World of Ten Billion People," reprinted in *Food, Ethics, and Society*, ed. Anne Barnhill et al. (New York: Oxford University Press, 2016).

9 C. Smith-Spangler et al., "Are Organic Foods Safer or Healthier than Conventional Alternatives? A Systematic Review," *Annals of Internal Medicine* 157 (2012): 348–366. Again, there are sometimes wide differences with respect to nutrition between particular items bought at a particular time at a particular location, due primarily to the fact that nutrients decay quickly after harvest in some foods; for discussion, see K. Frith, "'Is Local Food More Nutritious?' It Depends," Harvard Center for Health and the Global Environment, 2007, http://chge.med.harvard.edu/resource/local-more-nutritious . Similarly, there are sometimes wide and systematic differences with respect to pesticide levels; for discussion, see the Environmental Working Group report, "EWG's 2017 Shopper's Guide to Pesticides in Produce," http://www.ewg.org/foodnews/summary.php , which provides possible grounds for objecting to the claim that organics are no better than conventionals regarding dangerous pesticide levels (where the objection might be that even though it might be true that organics are no better 99% of the time, it is the 1% of the time that matters). For a report claiming that "overall pesticide residues found in foods are at levels below the tolerances set by the U.S. Environmental Protection Agency," see USDA, "Pesticide Data Program: Annual Summary 2014," https://www.ams.usda.gov/sites/default/files/media/2014%20PDP%20Annual%20Summary.pdf .

10 David Tilman et al., "Global Food Demand and the Sustainable Intensification of Agriculture," *Proceedings of the National Academy of Sciences* 108 (2011): 20260–20264. For a summary of these issues, see J. Foley, "A Five-Step Plan to Feed the World," *National Geographic*, 2014.

11 D. Lobell et al., "Climate Trends and Global Crop Production since 1980," *Science* 333 (2011): 616–620. The article notes that so far "winners and losers largely balanced out" for soybeans and rice.

12 United Nations Intergovernmental Panel on Climate Change (IPCC), "Food Security and Food Production Systems," *Climate Change 2014: Impacts, Adaptation, and Vulnerability*, final draft released, March 31, 2014, http://www.ipcc.ch/report/ar5/wg2 . See also T. Wheeler and J. von Braun, "Climate Change Impacts on Global Food Security," in *Science* 341 (2013): 508–513.

13 See Stephane Hallegatte et al., *Shock Waves: Managing the Impacts of Climate Change on Poverty* (Washington, DC: World Bank, 2016), 56.

14 See, e.g., Paul Ehrlich and Anne Ehrlich, "The Food Threat to Human Civilization," Project Syndicate, 2013, https://www.project-syndicate.org/commentary/human-population-growth-has-become-unsustainable-by-paul-r--

ehrlich-and-anne-h--ehrlich ; compare and contrast Paul Ehrlich, *The Population Bomb* (New York: Ballantine Books, 1968). For the history and criticism of population-control policies of the previous century inspired by similar arguments, see Matthew Connelly, *Fatal Misconception* (Cambridge, MA: Harvard University Press, 2010). For a view that rejects coercive policies, as well as the very large population reductions suggested by the Ehrlichs, see Amartya Sen, "Population, Food, and Freedom," in his *Development as Freedom* (New York: Anchor Books, 1999). The discussion here will set aside debates about the human population and food systems. The assumption for the sake of argument will be that Sen is largely correct about the mechanisms relevant to global population and well-being and that attempting to reduce food demand to match current food supply would be a cure worse than the disease, partly because it would require coercive mechanisms deployed almost exclusively against the global poor when instead a better outcome is available by increasing food production (in the way leading models cited here suggest), in conjunction with non-coercive population policies (such as merely making birth control readily available).

15 D. Tilman et al. report that "the coming 50 years are likely to be the final period of rapidly expanding, global human environmental impacts" ("Agricultural Sustainability and Intensive Agricultural Practices," *Nature* 418 (2002): 671–677).

16 As the saying goes, the road to hell is paved with good intentions.

17 For an overview, see Laura Valentini, "Introduction: The Problem of Global Justice," in her *Justice in a Globalized World* (Oxford: Oxford University Press, 2012). For a collection of some leading papers, see Thomas Pogge and Darrel Moellendorf, eds., *Global Justice* (St. Paul, MN: Paragon, 2008).

18 Quoted in Worldwatch Institute, "Can Organic Farming Feed Us All?" 2006, http://www.worldwatch.org/node/4060 .

19 Ibid .

20 Thomas Pogge, *World Poverty and Human Rights*, 2d ed. (Cambridge: Polity, 2008); Charles Beitz, *Political Theory and International Relations*, rev. ed. (Princeton, NJ: Princeton University Press, 1999).

21 See the introduction to chapter 2 of Barnhill et al., *Food, Ethics, and Society*, for extended discussion of traditional debates over food aid and global food security, and explanation of arguments from Pogge and Beitz and their relevance to those debates; for philosophical discussion of the less-discussed issues highlighted here, see the introduction to chapter 3 and Helena de Bres, "Local Food: The Moral Case," both in Barnhill et al., *Food, Ethics, and Society*.

22 For a leading discussion of food sovereignty and objections to the international trade and agriculture regime, see William Schanbacher, *The Politics of Food* (Santa Barbara, CA: Praeger, 2010). See also Saturnino Borras and Jennifer Franco, "Food, Justice, and Land," Bina Agarwal, "Food Security, Productivity, and Gender Inequality," and Kym Anderson, "Food Price and Trade Policy Biases: Inefficient, Inequitable, Yet Not Inevitable," all in the *Oxford Handbook of Food, Politics, and Society*, ed. Ronald J. Herring (New York: Oxford University Press, 2015). For influential discussions of food sovereignty in public discourse, see "Declaration of Nyéléni," https://nyeleni.org/spip.php?article290; Raj Patel, *Stuffed and Starved* (Brooklyn, NY: Melville House, 2012); and Paul Thompson, *From Field to Fork* (New York: Oxford University Press, 2015).

23 See the essay by Madison Powers in this handbook for further discussion "Food, Fairness, and Global Markets"; see also works cited in preceding footnote.

24 Joseph Stiglitz, *Making Globalization Work* (New York: Norton, 2012); Angus Deaton, *The Great Escape* (Princeton, NJ: Princeton University Press, 2013), ch. 7; Angus Deaton, "Response to Effective Altruism," *Boston Review*, 2015, http://bostonreview.net/forum/logic-effective-altruism/angus-deaton-response-effective-altruism.

25 Relatedly, see Helena de Bres, "Local Food: The Moral Case," both in Barnhill et al., *Food, Ethics, and Society*.

26 Such an objection is suggested by Stiglitz, *Making Globalization Work*, and arguably captures an increasingly politically important objection to free trade regimes.

27 See, e.g., Charles Beitz, "Global Political Justice and the 'Democratic Deficit,'" in *Reasons and Recognition*, ed. R. Jay Wallace et al. (New York: Oxford University Press, 2011).

28 Most philosophers do not note that the most fundamental objective of the WTO and its predecessor the GATT as understood by its architects was to promote geopolitical stability, not free trade. This is an important oversight in the philosophical literature because it undermines arguments from premises about the free-trade suboptimality of the WTO to conclusions that the WTO is suboptimal—on the contrary, as with the UN Security Council, arguably the best feasible institution for achieving the fundamental goal of geopolitical stability might not be the best feasible institution for promoting some less important instrumental goals that are nonetheless more saliently associated with the institution.

29 Here I bracket the externalities associated with fossil-fuel use that now dominate the debate, which are not on point for questions about whether there is something wrong with using a resource beyond its replenishment rate.

30 Note that the italicized phrase makes this constraint more demanding insofar as the ecologically optimal level is higher than what might often be the current ecologically degraded levels caused by human interference (which might nonetheless involve harvesting at a rate that itself can be replenished). Compare Ray Hilborn and Ulrike Hilborn, *Overfishing: What Everyone Should Know* (Oxford: Oxford University Press, 2013), on the distinction between ecologically optimal yield and maximum sustainable yield for this distinction in the domain of fishing and fishery science. For something like an example of this notion of ecologically optimal yield in policy discourse, Robert Solow quotes a UNESCO

document: “Every generation should leave undiminished all the species of animals it found existing on earth.” Solow, a defender of the alternative conception of weak sustainability, summarizes his objection to such a definition on the grounds that “if you define sustainability as an obligation to leave the world as we found it in detail, I think that’s glib but essentially unfeasible. It is, when you think about it, not even desirable” (“Sustainability: An Economist’s Perspective,” 1991, reprinted in *Economics of the Environment*, 6th ed., ed. Robert Stavins (New York Norton, 2012)).

31 See, e.g., Herman Daly, “Georgescu-Roegen versus Solow/Stiglitz,” *Ecological Economics* 22 (1997): 261–266; for criticism on behalf of weak sustainability, see the articles in the same issue with the same title by Robert Solow and Joseph Stiglitz (267–268 and 269–270, respectively).

32 See Ken Arrow et al., “Are We Consuming Too Much?” *Journal of Economic Perspectives* 18 (2004): 147–172, which includes some discussion of whether the “per capita” condition should be added and evaluates whether we are likely overusing resources even from the perspective of weak sustainability. For some important objections to the details of many economists’ specific attempts to define weak sustainability, see Marc Fleurbaey, “On Sustainability and Social Welfare,” *Journal of Environmental Economics and Management* 71 (2015): 34–53. A classic defense of weak sustainability is R. Solow, “Sustainability: An Economist’s Perspective,” reprinted in Stavins, ed., *Economics of the Environment*. See also the similar definition now favored by the United Nations, according to which, use is sustainable just in case it “meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations World Commission on Environment and Development, Bruntland Commission Report, Our Common Future, 1987).

33 See Arrow et al. and Solow, cited in the previous note, for this kind of reasoning.

34 Again, D. Tilman et al. report that (partly because of peaking global population and Kuznets curve phenomena) “The coming 50 years are likely to be the final period of rapidly expanding, global human environmental impacts” (“Agricultural Sustainability and Intensive Agricultural Practices,” 671–677.

35 Some theorists might prefer to put the point another way: there is no indefeasible requirement to act sustainably—rather, we have at best defeasible reasons to act sustainably.

36 T. Garnett et al., “Sustainable Intensification in Agriculture: Premises and Policies,” *Science* 341 (2013): 33–34; H. C. J. Godfray et al., “Food Security: The Challenge of Feeding 9 Billion People,” *Science* 327 (2010): 813.

37 Tilman et al., “Agricultural Sustainability and Intensive Production Practices.”

38 E. Ostrom, *Governing the Commons* (Cambridge: Cambridge University Press, 1990); J. Burney et al., “The Case for Distributed Irrigation as a Development Priority in Sub-Saharan Africa,” *Proceedings of the National Academy of Sciences* 110 (2013): 12513–12517; M. Herrero et al., “Smart Investments in Sustainable Food Production: Revisiting Mixed Crop-Livestock Systems,” *Science* 327 (2010): 822–825; M. Herrero et al., “Biomass Use, Feed Efficiencies, and Greenhouse Gas Emissions from Global Livestock Systems,” *Proceedings of the National Academy of Sciences* 110 (2013): 20888–20893; H. Buffett, *Forty Chances* (New York: Simon & Schuster, 2013); N. V. Fedoroff et al., “Radically Rethinking Agriculture for the 21st Century,” *Science* 327 (2010): 833–834.

39 R. Paarlberg, *Food Politics*, 2d ed. (New York: Oxford University Press, 2013); Fischer et al., “Cropyields and Global Food Security.” For discussion of important challenges for ideally best market-based policy, see N. Muller and R. Mendelsohn, *Using Marginal Damages in Environmental Policy* (Washington, DC: AEI Press, 2013).

40 United Nations Intergovernmental Panel on Climate Change (IPCC), “Food Security and Food Production Systems,” in *Climate Change 2014: Impacts, Adaptation, and Vulnerability*; final draft released March 31, 2014, http://www.ipcc.ch/report/ar5/wg2; P. Havlik et al., “Climate Change Mitigation through Livestock System Transitions,” *Proceedings of the National Academy of Sciences* 111 (2014): 3709–3714; J. Hanspach et al., “Develop, Then Intensify,” *Science* 341 (2013): 713. It is important to note that the best response to climate change in our nonideal world may include measures to offset the negative effects of agricultural emissions without necessitating that those emissions are actually reduced—such as geoengineering via solar radiation management; for discussion, see David Keith, *A Case for Climate Engineering*, Boston Review Books (Boston: MIT, 2013).

41 Gordon Conway and Edward Barbier, *After the Green Revolution* (New York: Routledge, 1990); J. Pretty et al., “Resource-Conserving Agriculture Increases Yields in Developing Countries,” *Environmental Science & Technology* 40 (2006): 1114–1119; Rebecca Nelson and Richard Coe, “Agroecological Intensification of Smallholder Farms,” in *Oxford Handbook of Food, Politics, and Society*, ed. Ronald J. Herring (New York: Oxford University Press, 2015).

42 Tara Garnett and Charles Godfray, *Sustainable Intensification in Agriculture*, Food Climate Research Network and Oxford Martin Programme on the Future of Food, University of Oxford, 2012, 34.

43 Gordon Conway, *One Billion Hungry* (Ithaca, NY: Cornell University Press, 2012), 109.

44 See, e.g., Humane Society of the United States, “The Impact of Industrialized Animal Agriculture on the Environment,” http://www.humanesociety.org/assets/pdfs/farm/hsus-the-impact-of-industrialized-animal-agriculture-on-the-environment.pdf ; and Pew Foundation, “Putting Meat on the Table: Industrial Animal Production in America,” 2008, http://www.pewtrusts.org/~/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/industrial_agriculture/pcifapfinalpdf.pdf .

45 J. De Cordoba, "The Violent Gang Wars behind Your Super Bowl Guacamole," *Wall Street Journal*, 2014; S. Holmes, *Fresh Fruit, Broken Bodies* (Berkeley and Los Angeles: University of California Press, 2013); Barry Estabrook, *Tomatoland* (Kansas City, MO: Andrew McMeel, 2012); John Bowe, *Nobodies* (New York: Random House, 2008); I. M. Waugh, "Examining the Sexual Harassment Experiences of Mexican Immigrant Farmworking Women," *Violence Against Women* 16 (2010): 237–261.

46 S. Romero and S. Shahriari, "Quinoa's Global Success Creates Quandry at Home," *New York Times*, 2011; for some critical discussion, see Lisa Hamilton, "The Quinoa Quarrel," *Harpers*, 2014; Paarlberg, *Food Politics*.

47 The spreadsheet that contains the relevant calculations, data sources, and a description of the methodology behind this chart is available at http://www.budolfson.com/footprints. In brief, the numbers are based on the best data easily available, including in peer-reviewed sources, and the cells that do not have numbers are based on my own judgment, which aims for empirical accuracy, which the reader can judge for him- or herself, perhaps in conjunction with my more detailed explanation of the methodology. The shading based on numbers is done by the default three-color shading algorithm in Microsoft Excel 2010. Main sources of numerical data are D. Nijdam et al., "The Price of Protein: Review of Land Use and Carbon Footprints from Life Cycle Assessments of Animal Food Products and Their Substitutes," *Food Policy* 37 (2012): 760–770; K. Hamershlag, "What You Eat Matters," Environmental Working Group, 2011; CleanMetrics greenhouse gas footprint data, accessed at http://www.foodemissions.com/foodemissions/Calculator.aspx; M. Mekonnen et al., "The Green, Blue, and Grey Water Footprint of Crops and Derived Crop Products," *Hydrology and Earth System Sciences* 15 (2011): 1577–1600; M. Mekonnen et al., "A Global Assessment of the Water Footprint of Farm Animal Products," *Ecosystems* 15 (2012): 401–405; and the USDA National Nutrient Database for Standard Reference. Of particular note, the specific numbers for greenhouse gas footprints that I use from Hamershlag and CleanMetrics are near the median estimates reported in Nijdam, which is a survey of the peer-reviewed literature on land and greenhouse gas footprints, are also in line with the numbers reported in other peer-reviewed publications, and the numbers from Hamershlag and Mekonnen et al. are generally used for advancing "anti-animal products" arguments; so, for all of these reasons, there is no risk that these numbers have a "pro-animal products" bias. The numbers here are highly aggregated in the sense that they do not distinguish between, e.g., the footprint of navel oranges from Florida versus the footprint of Valencia oranges from Spain, when both are purchased in, e.g., Williston, North Dakota in October. Instead, the numbers here simply report a weighted average for all oranges. Many of the numbers are based on global weighted averages, although I use averages for the United States in many places where reliable data is readily available for that more specific region. Along these lines, it should also be noted that conventional production is essentially the basis for the numbers in the chart, as the numbers in the chart are based on an average for all goods of the general type mentioned actually produced, which is dominated by conventional production. For the reasons I have already outlined, many experts would argue that the numbers are worse along many dimensions for organics than conventionals.

48 It is standard in the peer-reviewed scientific literature to express footprints of food in per unit of nutrition terms. For example, see Nijdam et al., "The Price of Protein."

49 Peter Singer and Jim Mason agree that it is permissible to eat mussels and some other sustainably sourced mollusks in *The Ethics of What We Eat* (Santa Barbara, CA: Rodale, 2007), but beyond this judgment of mere permissibility, they do not seem to appreciate the substantial superiority of mussels and some other animal products to many vegan staples, even on a purely utilitarian view. For different arguments for the same conclusion that animal welfare values do not imply vegan eating is optimal, see Donald Bruckner, "Strict Vegetarianism is Immoral," in *The Moral Complexities of Eating Meat*, ed. Ben Bramble and Bob Fischer (New York: Oxford University Press, 2015). For more on bivalves, see Christopher Cox, "Consider the Oyster," *Slate*, 2010.

50 See, e.g., Mark Budolfson, "Consumer Ethics, Harm Footprints, and the Empirical Dimensions of Food Choices," in *Philosophy Comes to Dinner*, ed. Andrew Chignell et al. (New York: Routledge, 2015). For a different kind of objection to veganism, see the discussion of the inefficacy objection in the introduction to this handbook, and the discussion by Bob Fischer in this handbook, "Arguments for Consuming Animal Products." I discuss the inefficacy objection in Mark Budolfson, "The Inefficacy Objection to Consequentialism," forthcoming in *Philosophical Studies*.

51 See discussion in Tara Garnett and H. Charles Godfray, "Sustainable Intensification in Agriculture," Oxford Martin School Report, 2012, http://www.futureoffood.ox.ac.uk/sites/futureoffood.ox.ac.uk/files/SI%20report%20-%20final.pdf .

52 For this possible dynamic, and some puzzles about it, see Orazio Attanasio and Britta Augsburg, "Holy Cows or Cash Cows?" NBER, 2014, http://www.nber.org/papers/w20304 .