Should the consumption of farmed animal products be restricted, and if so, by how much?

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Abstract

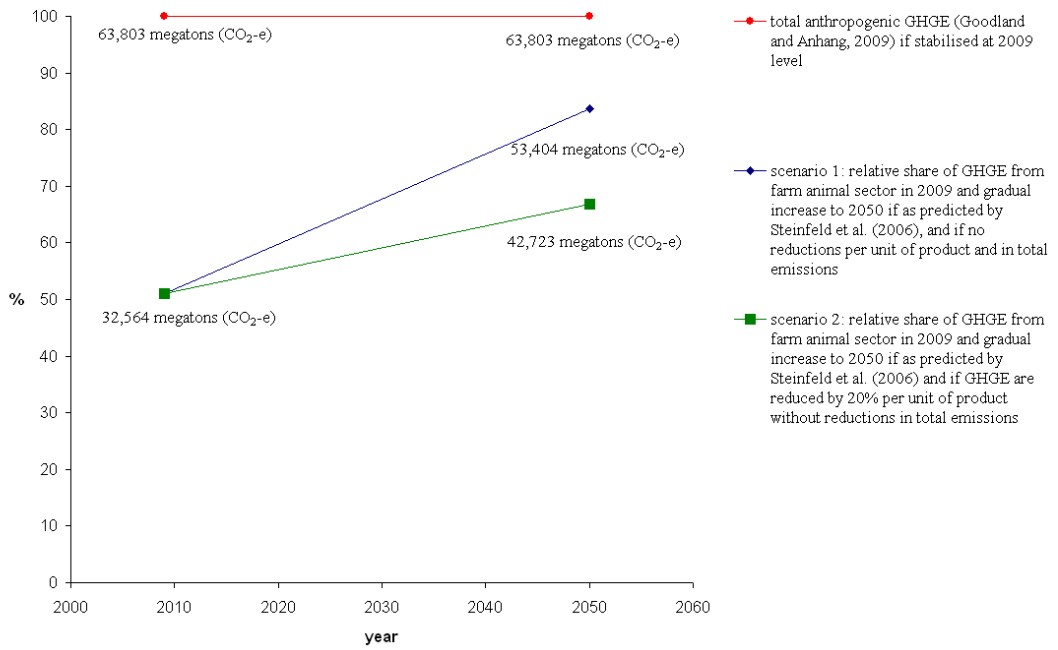
Recent studies have proposed that the consumption of farmed animal products must be curtailed to reduce anthropogenic greenhouse gas emissions. This paper argues that a careful assessment of the different emissions produced by different actual and potential diets is needed to evaluate whether or not restricting the consumption of farmed animal products could reduce greenhouse gas emissions, and if so, by how much. It is also argued that the question of whether or not the consumption of farmed animal products should be restricted must be addressed in the light of information derived from various sustainability indicators, rather than on the basis of a narrow focus on greenhouse gas emissions. A case study from the UK is used to develop a broader understanding of how dietary modifications might reduce a range of problems associated with the consumption of farmed animal products. It is argued that even more comprehensive studies of the different GHIs (‘Global Health Impacts’) are needed to assess the merits and demerits associated with the consumption of farmed animal products.

Keywords: animal products; climate change; diet; ecological footprint; ethics

1. The consumption of farmed animal products and climate change

Over the last fifty years, the increase in the consumption of farmed animal products has been unprecedented. Most notably, the consumption of animals’ body parts – referred to frequently by the name of ‘meat’ – has increased by about fourfold, growing from 70,507,182 metric tons in 1961 to 272,883,818 metric tons in 2006 (FAO, 2008). While the consumption of farmed animal products has now stagnated at high levels in many relatively rich countries, in less affluent countries consumption has more than doubled in the last thirty years, and is continuing to rise rapidly, particularly in China and East Asia (Steinfeld et al., 2006, pp. 15-16). A number of recent studies have questioned this increase as the farm animal sector is a major contributor to anthropogenic greenhouse gas emissions (Steinfeld et al., 2006; McMichael et al., 2007; Carlsson-Kanyama & González, 2009). A worrying trend is that the farm animal sector’s emissions are still rising. In an influential report with the title ‘Livestock’s Long Shadow’, published by the Livestock, Environment, and Development Initiative, a group co-ordinated by the Food and Agriculture Organization of the United Nations, the authors predict that the demand for farmed animal products will double by 2050 relative to consumption levels in 2000 (Steinfeld et al., 2006: 275). However, while total anthropogenic greenhouse gas emissions continue to rise, signatories to the Copenhagen Accord have agreed ‘that deep cuts in global emissions are required' (UNFCCC, 2009, p. 5). In figure 1, the relative share of emissions from the farm animal sector is shown based on data supplied by Goodland and Anhang (2009) for the year 2009. While 51% of all anthropogenic greenhouse gas emissions already come from the farm animal sector, it shows that the sector's relative share would be either 83.7% or 66.9% in 2050 if total annual emissions remain unchanged, the former scenario being realised if no reductions are achieved per unit of product and the latter if, on average, reductions by 20% per unit are achieved. This shows that the farm animal sector is the largest contributor to anthropogenic climate change and that its contribution will grow significantly if consumption rates increase in line with the predictions of the authors of the 'Livestock's Long Shadow' study (Steinfeld et al. 2006).

Figure 1: Relative share (in %) and total (in megatons) of actual (2009) and projected (2050) greenhouse gas emissions (GHGE) from the farm animal sector if annual anthropogenic GHGE stabilise at 2009 level



In a controversial paper, Anthony McMichael et al. (2007) (henceforth: McMichael) have proposed that, to stabilise greenhouse gas emissions from the farm animal sector by 2050 relative to its contribution in 2005, the global per capita consumption of animals' body parts should drop from the current average of 100 grams (g) per person per day to an average of 90 g per person per day (with less than 50 g coming from ruminants). As many people who live in the Western world exceed this figure considerably, such a consumption threshold would demand drastic dietary changes from a large number of people. For example, the average citizen of the United Kingdom (henceforth: UK) consumed around 79.6 kilograms of animals' body parts in 2002, equating to around 218 g per day, a level which would therefore need to be reduced by more than half (EarthTrends, 2009). McMichael argues that his conclusion stands subject to a range of conditions. These include the assumptions that the global human population will have increased by no more than 40% by 2050; and that current emissions would be reduced by 20% per unit of body part (McMichael et al., 2007, pp. 1253-1254). I have argued elsewhere that this proposal is subject to various problems, including the fact that the consumption of other animal products must also be reduced to achieve this objective, that a 20% reduction is both unlikely to work and irrelevant to assess what duties those who live in the present should have, and that the sector would fail to make a fair contribution to climate change abatement strategies by adopting such a modest target (Deckers, 2010). My focus here, however, will be on McMichael's underlying premise, namely the view that significant reductions in greenhouse gas emissions could be achieved by a reduction in the consumption of farmed animal products. Having addressed this issue, I shall then argue that the attempt to ground a moral duty to restrict the consumption of farmed animal products in a duty to limit greenhouse gas emissions is bound to fail unless this duty is considered in the light of a more general duty.

On the first issue, relatively few yet an increasing number of studies have compared the greenhouse gas emissions of different diets. One of the most influential studies is a study carried out in the United States of America (henceforth: USA), which revealed that the mean diet of a USA citizen, including 27.7% of calories from animal sources (comprising 41% from dairy, 5% from eggs, and 54% from a range of animals' body parts), produces at least 1.5 tonnes more emissions (measured in CO_2-equivalents per person) per year compared with the emissions produced by a vegan USA citizen (Eshel and Martin, 2006, p. 13). To give some idea of how this compares with the emissions produced by personal transportation, the authors point out that the per capita car miles travelled by the average USA citizen in 2003 were 8332 miles, producing between 1.19 and 4.76 tonnes of CO_2 emissions, depending on which vehicle was used (Eshel and Martin, 2006, pp. 2-3). To put it differently: if we imagine that the person adopting the mean diet of the USA citizen drives an averagely efficient car (Toyota Camry) and that a vegan compatriot drives one of the most energy-efficient hybrid vehicles (Prius) on the USA market in 2006, the difference in diet-related emissions (for a given quantity of food with equal caloric intake) amounts to the difference in emissions produced by the former driving 143 miles in the less efficient car and the latter driving 100 miles in the more efficient car. Or, to use a different analogy, the difference in emissions between the person adopting the mean USA diet and the person adopting the vegan diet also corresponds to the difference in emissions between driving 8332 miles (the distance travelled by the average USA citizen in a year) in one of the most efficient cars and not driving at all.

If we now assume that an enlightened omnivore would be willing to use no more than half of the animal products consumed in the mean USA diet and that the proper and large-scale use of new technologies could reduce the greenhouse gas emissions related to the production of farm animal products by 20%, enlightened omnivores living in the USA would still produce 0.6 tonne more greenhouse gas emissions per year compared to their vegan compatriots (which comprise no more than per 1.4% of the population according to a poll carried out in 2006) (Stahler, 2006). These findings are confirmed by a recent Swedish study, where the greenhouse gas emissions of three Swedish meal options were compared. The difference between the hypothetical vegan meal and the two hypothetical meals that included animal products varied between a factor of three and a factor of eleven, depending on which kinds of animal products were chosen (Carlsson-Kanyama & González, 2009, p. 1708S). In spite of these significant differences, the authors comment that 'research is needed to understand why dietary change is not on the climate change agenda' (Carlsson-Kanyama & González, 2009, p. 1704S). I argue the more important moral point that diet should be on our moral agenda, not in the least when it comes to determining what our duties are in relation to climate change. To avoid dangerous climate change which – as has been argued by many, including Simon Caney (2006 and 2009) and Derek Bell (in press) – would jeopardise human rights, the Intergovernmental Panel on Climate Change (2007, p. 20) has claimed that a reduction in CO_2 emissions of up to 85% relative to 2000 levels may be required by 2050. On this basis, Rosales (2008, p.

1414) has calculated that this leaves no more than an average of 0.8 tonne per capita per year.

2. The consumption of farmed animal products as a global health issue

While the greenhouse gas emissions associated with diets deserve more ethical scrutiny than they have received so far, at least if we are serious about human rights, the fact that many people's diets are associated with relatively large amounts of greenhouse gas emissions need not necessarily be a moral problem. This is so because the issue of what counts as a fair diet should not be treated in isolation from the question of what counts as a fair threshold of negative 'global health impacts' or 'GHIs' which each person should not be allowed to exceed, a point I have elaborated on elsewhere (Deckers, 2010). With this I adopt the view that health should be the only thing that matters when we consider how we need to act or refrain from acting in relation to biological organisms (and that bioethics should essentially be about health protection and promotion). Therefore, when we consider the moral quality of any particular action, we must assess its potential health impacts. The word 'global' has been added to emphasise three things. Firstly, it aims to highlight the view that the concept of health should be understood broadly when we assess the health impacts of our (proposed) actions. It emphasises a holistic understanding of health, whereby health is taken to stand for a state of all-round functioning or flourishing. Secondly, it emphasises that the consequences of our actions upon the health of the global population of human beings should be considered, including those who are more remote in space and time. And thirdly, since I adopt the view that human beings cannot function optimally without paying appropriate attention to the question of how their actions impact upon the health of nonhuman organisms, the word 'global' also refers to the need to consider the effects of our actions upon all nonhuman organisms that live on our globe, to the need to consider global ecosystemic effects. While some might object to this account by claiming that there should be many other things that deserve moral consideration, for our present purposes this should not concern us. Provided no overriding concern can be found, it can be concluded safely that we all have a general duty to avoid damaging others' health unfairly and that we should consider dietary obligations in light of this general duty.

While I shall ignore the important issue of what our duties might be towards nonhuman things, it is clear that there is no reason to think that the duties that we might have towards other human beings are exhausted by any duties we might have in relation to climate change. We can affect each other either positively or negatively in a plurality of ways, and our diets are no exception to this general rule. Therefore, in order to obtain an accurate picture of how diets might be morally suspect, we must consider all the different ways in which diets can impact on the health of others. This implies, for example, that we need to assess also how different diets and dietary changes might affect the availability and distribution of food, for example in relation to the question if they are likely either to contribute to or to reduce the number of malnourished people in the world, which has now been estimated to be more than 1 billion (FAO, 2009). It also includes the need to consider the different contexts in which diets are adopted. Two diets that are identical might nevertheless produce very different negative GHIs. This is ignored by McMichael, who argues that all countries eventually should reach the same average per person consumption level of 90 g of animals' body parts per day (McMichael et al., 2007, p. 1253). In this way, he fails to take into consideration the different circumstances in which people living in different countries find themselves. For example, some countries may rely more on the consumption of farmed animal products because they may lack sufficient alternatives that are suitable for human consumption. Therefore, the consumption of farmed animal products may be the option which produces the least greenhouse gas emissions compared to its alternatives where these would need to be imported from places that are far away. If the alternative options produced more greenhouse gas emissions, it would seem to be contrary to McMichael's goal to stabilise greenhouse gas emissions from the agricultural sector to expect people in such countries to reduce their intake of farmed animal products.

More work is needed on the issue of what should count as a fair share of negative GHIs for each person. It is clear that the issue of how many farmed animal products someone consumes should not be treated in isolation, but as an important part of the larger question of how people can make sure that their negative GHIs do not exceed what is their fair share. Indeed, many people may well prefer either to reduce their negative GHIs elsewhere, for example by reducing the emissions produced by the consumption of domestic energy or transport, or to offset some of their negative GHIs by producing positive GHIs, for example by planting trees. However, in order to be able to assess if significant amounts of negative GHIs are associated with one's dietary choices, it is necessary to move beyond an approach whereby only the greenhouse gas emissions of dietary choices are put into the equation.

3. The consumption of farmed animal products and the ecological footprint concept

While the GHI concept measures the impact of human actions on human health in one common unit, the concept of 'ecological footprint' measures the impact of human activities on the nonhuman environment in one common unit, the use of bioproductive space. While human health is affected by much more than by the use of bioproductive space, it has nevertheless been claimed that the ecological footprint is 'the most comprehensive and most widely adopted overall measure of threats to environmental sustainability', and this indicator or standard has itself been understood as one of the most important ways to measure the impact of 'environmental stressors' on human health (Dietz et al., 2009, p. 118). For this reason, I shall use estimates of dietary ecological footprints to obtain a more accurate picture of the negative GHIs associated with the consumption of farmed animal products. The notion of 'ecological footprint' was coined in the 1990s by William Rees and Mathis Wackernagel and stands for the 'amount of biologically productive land and water area an individual, a city, a country, a region, or all of humanity uses to produce the resources it consumes and to absorb the waste it generates under current technology and resource management practices' (Wackernagel & Rees, 1996; Kitzes & Wackernagel, 2009, p. 813; Rees, 2003, p. 898). It is important to emphasise that only materials created biologically and their waste products are taken into consideration as 'materials such as plastics that are not created by biological processes nor absorbed by biological systems do not themselves have a defined Ecological

Footprint' (Kitzes & Wackernagel, 2009, p. 814). However, the effects of such materials on biological systems are taken into consideration.[1]

Rees has calculated that there are only 1.8 hectares of biologically productive water and land per person on this planet to live sustainably, which is exceeded by the 2.2 hectares that are used by the average person living today. Since the global biocapacity or human carrying capacity is exceeded by more than 20%, Rees (2003; 2006) therefore concludes that the world is in 'overshoot' as biological resources are consumed at a faster rate than the rate by which they can be replenished.[2] Since most people living in affluent countries exceed the average amount of 'global hectares' – the averaged amount of land that is needed to produce any particular commodity that is consumed and to deal with its waste – that are available per person by a large margin, Rees (1996, p. 195) has

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[1] Since Rees and Wackernagel included the areas needed for waste assimilation, emissions of carbon dioxide have been included, yet no other emissions. The relative weight of these emissions within one's ecological footprint has been determined by the area of forest that would be required to assimilate those emissions, an approach that has been criticised not only because there are other ways in which carbon emissions could be sequestered, yet also because subjective opinions might influence the used conversion rates (Van den Bergh & Verbruggen, 1999). A similar problem underlies the calculation of the ecological footprint of nuclear energy, which has been 'set at par with fossil fuel energy, for lack of a consensus on an alternate methodology' (Moran et al. 2009, p. 1943). In other words, it has been determined by the amount of land that would be required to offset the CO_2-equivalent of nuclear energy.

[2] Rees (2006) refers to Catton (1980) for the concept of 'overshoot'.

concluded that ‘most so-called ‘advanced’ countries are running massive unaccounted ecological deficits with the rest of the planet’. For example, the average ecological footprint for a UK citizen, the country in which this author resides, is 5.3 global hectares, or about three times the amount of biologically productive hectares that are available for each person in the world (Global Footprint Network, 2008). Yet, at the same time, many people lack sufficient ecological space to satisfy their fundamental interests. If we assume that Rees is right that we are in overshoot, we are not only faced with the question of what overshooting countries should do to reduce their ecological deficit, but also with the question of how many resources and how much waste each of us should be allowed to, respectively, consume and produce without jeopardising the rights of others unfairly.

While some activities may use relatively few resources and produce little waste, they might nevertheless be very damaging for human and nonhuman health. Therefore, a relatively large negative GHI need not necessarily be associated with a relatively large ecological footprint. However, those who have relatively large ecological footprints would have relatively large negative GHIs unless they produce relatively large quantities of positive GHIs by their actions. We can therefore get some indication of our negative GHIs by estimating our ecological footprints. Ecological footprint calculators have been developed to estimate the ecological footprints of different categories of individuals living in different parts of the world. The Global Footprint Network, an organisation set up in 2003 to promote sustainability, is updating its footprint calculator at the present time, and therefore data can only be obtained for people living in a few countries. If the calculator is used to estimate the footprint of a USA citizen who lives in a free-standing home with running water and electricity where three people live together and where mean values (as indicated) are chosen for all remaining categories, a marked difference can be observed between the ecological footprint of a male person who eats animals' body parts 'a few times a week and eggs/dairy almost daily' and a male person who never eats animal products. The former would use about 9.2 global hectares (22.9 global acres) while the latter would use about 8 global hectares (19.9 global acres) (Global Footprint Network, 2010).[3]

One problem with using such ecological footprint calculators is that they do not allow users to obtain accurate knowledge of what the ecological footprints of individual diets and dietary components are, and how they are calculated. A second problem is that no greenhouse gas emissions have been included other than carbon dioxide emissions. However, it has been argued that, when it comes to calculating the ecological footprints of diets, including the emissions of other gases, most notably methane and nitrous oxide emissions, could add substantially to one's dietary ecological footprint (Walsh et al., 2009). In this respect, many farmed animal products do not fare very well, a point made by the authors of the 'Livestock's Long Shadow' report (Steinfeld et al. 2006). Taken as

[3] The water footprint measures the freshwater required to produce a thing. It has been estimated that the water footprints of diets that include farmed animal products are also higher than those that exclude them (Hoekstra, 2009, p. 1971). Adequate consideration must be given, however, to the question of how diets might differ in relation to the amount of irrigation that is required to produce a given unit of food, as growing water scarcity suggests that using rainwater may be preferable over using alternative water sources.

a whole, the report estimates that the farm animal sector accounts for about 37% of all anthropogenic methane emissions, a greenhouse gas that does not remain in the atmosphere as long as CO_2, yet that has a global warming potential that is 72 times that of CO_2 over 20 years, and for 65% of anthropogenic nitrous oxide emissions, a gas with a global warming potential that is 289 times that of CO_2 over 20 years and that also contributes to the hole in the ozone layer (Steinfeld et al., 2006, p. xxi; Forster et al., 2007). A more recent study, however, has provided evidence to support the claim that these findings are gross underestimates, caused – amongst other things – by the exclusion of emissions produced by respiration, and that the farm animal sector would account for 51% of all anthropogenic emissions in CO_2-equivalents (Goodland and Anhang, 2009). A third problem is that these calculators only reflect a part of the natural capital costs associated with human diets, ignoring the human health and human capital costs of resources produced and absorbed biologically, and the costs associated with the production, disposal, and health effects of substances that do not break down biologically. A final problem is that potential changes in production and consumption patterns that might result from dietary changes have not been taken into consideration. Yet these might be highly relevant, for example to determine if sufficient fruits and vegetables that had not been imported would be available to provide for healthy diets should diets that exclude animal products be adopted widely. While it must be concluded that, on average, the negative GHIs associated with the consumption of farmed animal products are relatively large if ecological footprint calculators provide reliable information to assess negative GHIs, the development and use of broader, quantified indicators that allow users to obtain accurate information of how calculations are made would be highly desirable.

4. The negative GHIs associated with the consumption of farmed animal products in the UK

In this respect, a study carried out by Jules Pretty et al. (2005) (henceforth: Pretty) – published in this journal – provides a good opportunity to develop our understanding of the negative GHIs associated with different diets, as the study aims to include at least some of the costs that are not reflected by current ecological footprint calculators. It must be stressed that the study, which aims to examine the real cost of the average weekly UK shopping basket, is limited to the UK. It compares the externalities to the farm gate for 12 food commodities that are produced in the UK. The concept of 'externality' is defined – in an earlier study co-authored by Pretty – as 'any action that affects the welfare of or opportunities available to an individual or group without direct payment or compensation, and may be positive or negative' (Pretty et al., 2001, p. 265). Before examining the findings of this study, it is worth noting that these externalities are underestimates, as only external costs are included, i.e. 'the costs incurred by the rest of society for the actions of farmers' (Pretty et al., 2000, p. 116), and 'only those externalities which give rise to financial costs' for the UK (Pretty et al., 2001, p. 268).

In spite of these limitations, Pretty's study is interesting as it factors in a large number of externalities which are frequently overlooked in discussions about diet. These include the costs associated with the following: the use and/or treatment of pesticides, nitrates, phosphates, soil erosion, BSE (including new variant CJD) and other pathogens (including food poisoning problems caused by Cryptosporidium, Bacillus, Campylobacter, Clostridium, Escherichia coli, Listeria, Salmonella, and Small Rounded Structured Virus); eutrophication (excluding marine eutrophication); monitoring and the provision of advice on pesticides and nutrients; methane, ammonia, carbon dioxide, and nitrous oxide emissions; biodiversity and wildlife costs; losses of landscape features (such as hedgerows); bee colony losses; and acute health effects related to the use of pesticides (Pretty et al., 2000; Pretty et al., 2001). There is no doubt that some of the estimates used in the study to assess these costs are subject to debate in light of the personal values of the authors of the study which the article published in 2005 relies on (for example, the costs attached to bee colony losses), and of what they call 'the multifaceted and dynamic nature of agriculture and its impact on the environment and human health' and the personal values of the authors, yet they claim that the estimates 'are likely to be conservative' (Pretty et al., 2000, p. 118). While it is beyond the scope of this study to discuss if the figures provided by Pretty are accurate, the results of this study provide food for thought, especially if we use the data to examine the externalities produced by the average actual UK diet (which includes farmed animal products) and a hypothetical vegan diet (which excludes animal products).[4]

If we base our estimates on the food that is actually consumed, rather than produced in the UK (thus allowing for what the authors refer to as 'adjustments … to account for losses in the supply chain and distortions arising from imbalances in imports

[4] For details on how costs were estimated, see Pretty et al., 2000, pp. 117-130 and Pretty et al., 2005, pp. 3-4.

and exports') (Pretty et al., 2005, p. 7), striking differences between the costs of the average actual UK diet and a hypothetical vegan diet can be observed.[5] The costs of these externalities were calculated by Pretty et al. (2000) for the year 2000, and the assumption has been made that these costs have remained unchanged. To calculate the difference between the average UK diet and a hypothetical vegan diet, data collected by DEFRA were used. These reveal per person estimates of the quantities of different food items that are consumed every week within UK homes (– data for what was consumed outside the home were ignored as the food categories did not match). While Pretty's data were based on averages for 1999-2000, more recent DEFRA (2008) data were used to establish estimates of the components of the UK diet in 2007, the latest year for which data were available at the time of writing. If we assume that 1 litre of milk products weighs 940 g and that 1.6 eggs weigh 100 g, the externalities for the consumption of a range of animal products totalling 3204 g are 55.8 p. A further 165 g of fish products must be added for which no externalities were calculated.[6] In addition, 5136 g of non-animal products are consumed, adding 12.09 p of external costs.[7] In total, the average UK citizen therefore

[5] Regrettably, the authors do not explain how these adjustments were calculated.

[6] No externalities were calculated for the consumption of fish as no reliable data were available.

[7] For the category of 'fats', the assumption was made that 50% of animal fats and 50% of vegetable fats were included. To calculate 2007 data, externalities were calculated as factors of the externalities, rounded to tenths of a penny, for weekly averages in weight consumed over 1999-2000 (Pretty et al., 2005, p. 8, table 3). The assumption was made

consumes 8505 g of food within the home per week. The calculated external costs from current agriculture for this food basket are 67.89 p.

To calculate how this compares to a hypothetical vegan diet, I adopt David and Marcia Pimentel's (1996, p. 74) estimate that a vegan would have to consume 1.4 times the amount in weight of the animal products consumed by average UK citizens to obtain a similar nutritional value. In other words, an additional 4717 g of non-animal foods would need to be consumed to replace the 3204 g of animal foods for which externalities were calculated and the 165 g of fish products for which no externalities were calculated. If we assume that these 4717 g would be derived from equal shares of the food components that make up the 5139 g of non-animal food products that are currently consumed and that no additional costs per unit of food are incurred, a vegan would produce 23.21 p (12.09 p + 11.12 p) of externalities, based on the costs estimated to be associated with current UK consumption patterns of non-animal foods.[8] If we were able

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that the data for 'liquid milk' and 'other milk and cream' in the table were not expressed in g, but in ml (as in the DEFRA studies which Pretty relies on).

[8] A question that remains to be addressed is whether or not such a diet would meet recommended daily allowances for all nutrients. For example, if an estimated average requirement of 0.66 g per kg per day is taken for good-quality protein (Food and Nutrition Board, Institute of Medicine of the National Academies, 2005), some diets that are low in farmed animal products might be deficient. However, whilst conceding a significant degree of uncertainty, a recent study has claimed that 'there is no reason why' the study which produced this estimate should assume that less than 50% of good-quality is utilised by the human body, and that well-chosen vegan diets can meet protein

to add the externalities related to the consumption of fish products, it can be estimated that the externalities produced by the hypothetical vegan diet would be about one third of the externalities produced by the diet adopted by the average UK citizen in 2007.[9] Pretty

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requirements as well as recommended intakes for other nutrients (Millward and Garnett, 2010, p. 109). Since the current average protein intake in the UK has been estimated to be around 78 g per person per day, however, many UK citizens exceed the estimated average requirement by a long margin (DEFRA, 2010, p. 13).

[9] While it is beyond the scope of this paper to present detailed evidence on this, the externalities related to the current consumption of fish are likely to be high. The costs related to the environmental degradation caused by fishing and the species losses caused by overfishing are significant, yet may be undervalued (Myers & Worm, 2003). After examining the energy costs of fishing, Gidon Eshel and Pamela Martin (2006) conclude that typical Western diets which include fish are more inefficient compared to plant-based diets, especially since long-distance boat journeys are associated with the catching of fish preferred by Western customers. This is confirmed by Reijnders and Soret (2003, p. 667S), who refer to evidence indicating that the fossil fuel requirements for trawler fishing – the prevailing fishing method in Western Europe – is 14 times larger than the amount needed to produce an equal amount of plant protein in Western Europe. This excludes the high emissions that are frequently used to process fish, for example the emissions produced by canning and refrigeration. High emissions for cod fishing were also calculated by Carlsson-Kanyama and González (2009, p. 1707S). Aquaculture is also associated with high negative GHIs, especially because of its use of pesticides, prophylactic antibiotics, eutrophying nutrients, and its use of other fish as feed (Cole et

also compared these externalities with those that would be produced if similar quantities of different food items that are now consumed in the UK would be produced by a scenario wherein the whole of UK agriculture would operate within a certified organic system according to the standards set by Soil Association Certification Ltd, a subsidiary of the Soil Association which provides trademarks for organic produce in the UK. While I shall not discuss this imaginary scenario in detail, the estimates provided by Pretty reveal an even greater difference between the average omnivorous diet and a hypothetical vegan diet (Pretty et al., 2005, p. 8). This is so irrespective of whether consumption data for 2007 or for 1999-2000 are used.

While Pretty et al. (2005, p. 1) claim to estimate 'the real cost of the per capita UK food basket', it must be pointed out that the study is subject to some limitations. Firstly, the study assumes that, for 'the 12 commodities assessed', the costs – up to the farm gate – incurred for the food that is produced outside the UK within each 'commodity' are the same as those for the food that is produced inside the UK (Pretty et al., 2005, p. 1). The problem with this assumption is that the costs up to the farm gate for different items of 'fruit', for example – one of Pretty's 'commodities' – may vary greatly depending on which kinds of fruits are grown and where they are grown. For example,

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al., 2009). While many aspects of the fishing industry are associated with relatively large negative GHIs, it is also clear that the consumption of some fish (e.g. herbivorous fish kept in nearby ponds) can be associated with relatively small negative GHIs on humans (that is: if we ignore considerations related to the ways in which humans ought (not) to treat fish), yet their potential to contribute to a substantial part of the diets of the growing human population may be limited.

the costs of growing tomatoes in the UK may be significantly greater than the costs of growing them in Spain.

Secondly, Pretty provides no suggestion about whether or not, and if so, how the external costs incurred by the animal feed that is imported to feed UK animals have been factored into the equation. These costs are bound to be particularly high (and undervalued), at least for particular feeds, for example for soya meal derived from soya beans grown on land that was deforested to provide for these. The soybean industry is also contributing to deforestation by other human enterprises, as it is – to use the words of Tara Garnett (2009, p. 494) – 'an important 'push' factor' by competing with other enterprises for land. Many cattle ranchers who possessed lands suitable for soybean production have been able to sell off their lands at great profits due to increases in land prices stimulated by the soybean industry, and have used their profits to buy other lands that are cheaper and less suited for soybean production. The European ban on feeding animal products to farm animals subsequent to the BSE crisis resulted in a surge in imports of soybeans into the European Union. It has been estimated that about ten million hectares of soybeans that were grown in non-European countries are imported to the European Union annually, representing an area that corresponds to 10% of the arable land of the European Union (Elferink et al., 2007, p. 468). Since some of the animal products that are produced by using imported feeds are exported from the UK, their external costs cannot be attributed to UK diets. However, DEFRA (2004) data reveal that animal products are net imported in the UK, mainly from countries within the European Union. Since many animal products that are produced in the European Union also rely on imports of soya and other animal feeds, it is unlikely that the external costs of the animal feeds that are grown to produce these animal products are any lower than the external costs associated with the animal feeds that are imported to feed animals reared in the UK. In 2007, for example, a total of 35.8 million tonnes of soya meal was consumed by farm animals in the European Union, the largest part coming from Brazil (which prohibits the growth of genetically modified soya and exports about a third of its harvest to countries of the European Union) (van Gelder et al., 2008). If the costs of these imported animal feeds are not included in Pretty's analysis, the real costs of some farmed animal products would be significantly higher.

There are at least two further reasons why this might be so. Firstly, the costs from farm to fork for farmed animal products are likely to be greater than the farm to fork costs for fruits and vegetables, as the former require more processing, refrigeration, packaging, and cooking. Secondly, some costs are difficult to quantify in financial terms. For example, Pretty did not assess the costs that might be created by the development of antibiotic resistance (as they believe that 'it is currently impossible to estimate the external costs of antibiotic overuse') and the chronic health effects of pesticides (as they believe that 'with current scientific knowledge, it is impossible to state categorically whether or not certain pesticides play a role in cancer causation') (Pretty et al., 2000, pp. 128-129; Pretty et al., 2005, p. 3). Yet these costs might be highly significant when vegan diets are compared with omnivorous diets as the latter account for a larger share of such costs. This is so because large amounts of antibiotics are used to raise farm animals and significant quantities of pesticides are used in the production of feed crops (Anomaly, 2009). Other costs may also be difficult to quantify, for example the costs related to the treatment of obesity-related and zoonotic diseases, as well as the costs related to dealing with actual and potential infectious diseases, for example those incurred by avian or swine influenza and bovine tuberculosis. While some of the negative GHIs associated with the production systems that underlie omnivorous diets might be offset by the positive GHIs that they produce (including potential non-food related benefits), the question must be asked if at least the same amount of positive GHIs could not also be produced by the production systems that support vegan diets without increasing their negative GHIs if such diets were adopted more widely.[10] While people may have widely different views on what should count as negative and positive GHIs and on how their relative merits and demerits should be measured, the analysis presented above suggests that the answer to this question would be positive. This view is supported by Tara Garnett (2008, pp. 65-66) who – after an extensive examination of the environmental costs and benefits of the farm animal industry – concludes that the costs of farming animals ‘far outweigh the benefits’.

If this assessment is correct, several policy options could be chosen to curtail the negative GHIs associated with the consumption of farmed animal products. Available options include a complete or qualified ban on their consumption, the introduction of policies to educate people about the negative GHIs associated with the consumption of farmed animal products in the hope that people will make voluntary changes to curtail these, or the creation of policies to increase the costs of farmed animal products to

[10] For 1996, Pretty et al. (2001) calculated that the positive externalities of UK agriculture amounted to an amount that was between three and a half to ten times less compared to the costs of the negative externalities.

remedy their negative GHIs. The merits and demerits of these options have been discussed elsewhere (Deckers, 2010).

5. Conclusion

If the analysis presented in this paper is correct, many people living in the UK could reduce their negative GHIs by curtailing their intakes of farmed animal products. If people who exceed their fair share of negative GHIs are morally obliged to reduce them, they might consider making dietary changes. While the negative GHIs associated with the production of farmed animal foods may differ significantly between different ecosystems, those who consume farmed animal products and live in comparable ecosystems wherein similar agricultural systems are used as those that characterise production in the UK might also be able to reduce their negative GHIs by restricting their consumption of farmed animal products. Ethical discussions of food choice frequently focus on the greenhouse gas emissions produced by different human diets. As for McMichael, such a focus has been crucial for the authors of a report published by Compassion in World Farming (2007, par. 6.1), which has argued that those living in 'developed countries should reduce production and consumption of meat and milk to at least 60% below current levels by 2050'. I have argued that this should be a moral obligation only for those people (whichever country they live in) that would exceed their fair share of negative GHIs if they failed to do so, and who prefer this method of reducing their negative GHIs over any other methods that might be available. While the question of what should count as a fair share of negative GHIs is a matter that must be settled on another day, and a matter that should interest those who are involved in policy-making a great deal, there is no reason why those who estimate that their negative GHIs exceed what might be a fair share should wait for that day to come to scrutinise their dietary choices.

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