Food versus fuel? Going beyond biofuels

A Viewpoint Paper

Authors

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1. Introduction

Biofuels provide a renewable alternative to petroleum fuels used in transport. Political support has been essential in creating both the demand for biofuels, and the institutional frameworks that govern their use. Globally this support has been driven by three policy objectives: energy security, rural development and climate change (Rosillo-Calle and Johnson, 2010; Ackrill and Kay, 2014), and the relative importance of each objective has shifted over time in response to global and national concerns and pressures. During the 1980s, in the OECD countries, biofuels were positioned as a means of consuming persistent agricultural surpluses and supporting farmer incomes (e.g. POST, 1993). By the early 2000s, it was argued that biofuels would help reduce agricultural price volatility (Londo and Deurwaarder, 2007; Mol, 2007; Clancy, 2008) and provide a compensatory measure to reduced direct subsidies via alternative market creation (Sharman and Holmes 2010). However, despite initial expectations that biofuels would offer a broad platform of climate change, energy security and rural development benefits, in some OECD countries the importance of rural economy opportunities as a rationale for biofuel development has diminished over time (Boucher, 2012; Franco et al., 2010) to be replaced by a narrow focus on climate change mitigation (Palmer, 2012). Yet biofuels for rural development has remained an important impetus for many developing nations (Jumbe et al., 2009; McCarthy and Cramb, 2009); over the past decade, there has been an ongoing crisis in smallholder agriculture in the developing world characterised by falling public expenditure, fluctuating agricultural commodity prices and policy neglect (Koning and Mol, 2009; Rao, 2009; White and Dasgupta, 2010). Biofuels have therefore been promoted as a vehicle for rural development, for example by improving farm gate prices, farmer education, and technology transfer, enabling farmers to raise productivity (Mathews, 2007; Koning and Mol, 2009). However, whether and how biofuels contribute to rural economies is contested, and one of the most disputed impacts has been on food production and availability (Clancy, 2008; Rosillo-Calle and Johnson, 2010; Thompson, 2012a). The food vs. fuel argument calls into question the ethics of diverting land from food to energy production, and has two key facets: firstly, that demand for biofuels has an impact on food prices, which disproportionately affects poor people in the global South (e.g. Monbiot, 2004, 2007, 2012; Brown, 2009; Gamborg et al., 2012); and secondly, that it leads to competition with existing food production in established agricultural areas or requires expansion into new environs (e.g. Spangenberg, 2008; Searchinger et al., 2008).

The food vs. fuel debate was succinctly encapsulated by Jean Ziegler, the first UN Special Rapporteur on the Right to Food, who called biofuels a 'crime against humanity' for the food security implications (UN News Centre, 2007). Whilst delivering a powerful and emotive message, in this paper we argue that food vs. fuel presents a false dichotomy and one which masks complex linkages between land, food, feed, and energy markets. While the benefits of this simplified framing are clear - it provides a hook on which to hang criticisms of biofuels - we aim to draw attention to the complexities, issues and questions obfuscated by this frame. In this paper, we do not revisit the evidence on the impact of biofuels on food prices (see Kretschmer et al., 2012; Zilberman et al., 2012; Zhang et al., 2013; De Gorter et al., 2015), nor do we examine the moral and ethical arguments concerning biofuels, which have been explored elsewhere (see Thompson 2012a, 2012b; Gamborg et al., 2012). Nor do we argue for or against biofuels, again a false dichotomy given the diversity of crops, production and processing systems, and political economic contexts in which biofuels are developed and deployed. Rather we hope to initiate a discussion by drawing attention to the complex issues that lie behind the food vs. fuel argument. Drawing on our research on the political economies of biofuels in the UK, Europe and Latin America, we use the debate on food vs. fuel as a lens to examine the interdependencies between the multiple end-uses of biofuel feedstocks and the multifunctionality of land.

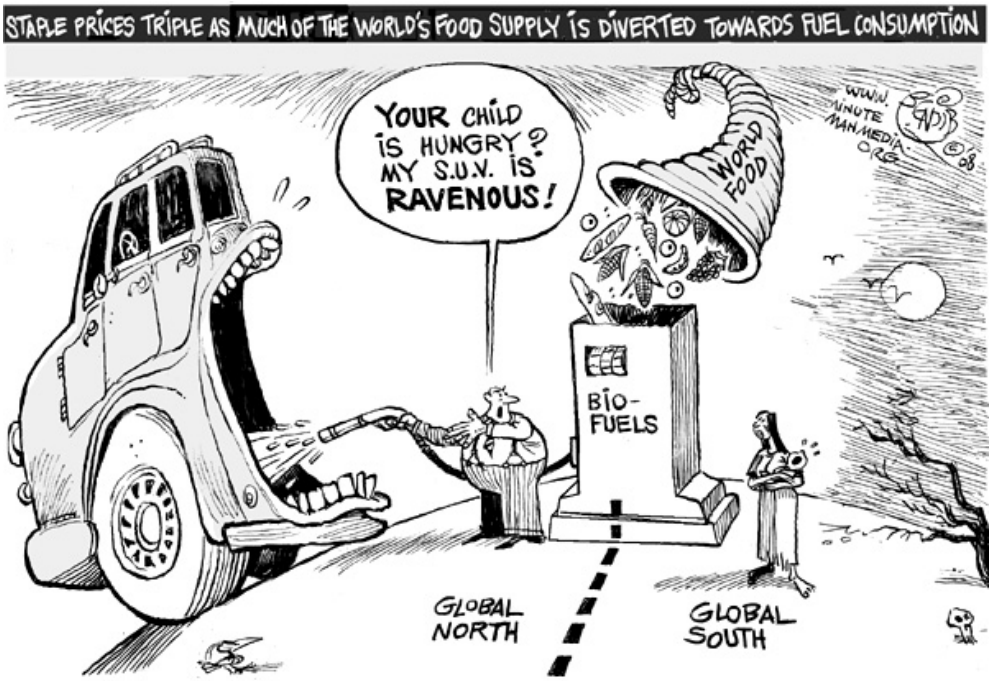
Given that the more advanced technologies, such as lignocellulosic and algal biofuels, have yet to emerge as commercially viable prospects, this paper focuses on the impacts of first generation biofuel technologies i.e. those produced from conventional food crops, such as maize, sugarcane, oil palm, wheat and soya. However, both lignocellulosic technologies utilising feedstocks such as miscanthus, switchgrass or willow (Murphy et al., 2011) and algal biofuels produced through the use of algae ponds (see Campbell et al., 2011; Park et al., 2011) still require land to be produced. Therefore, the potential for land use and food conflicts remains and will require continued assessment as these technologies emerge (Murphy et al., 2011). This is not to say that continued development of these advanced technologies should be abandoned or that government support, presently or in the future, should be dismissed on the basis of the impacts of first generation technologies and feedstock production regimes. Nonetheless, it is important to be mindful of the possible impacts that could be stimulated by the future expansion of later generations of biofuel technology that also rely on land for feedstock production.

The rest of the paper is structured as follows: in the next section we examine the emergence and content of food vs. fuel, before drawing attention to three issues that have been obfuscated by this frame. Firstly, we highlight the multiple end-uses of many so-called 'flex crops' which, in addition to food and fuel, may also be used to produce feed, fertiliser, bioplastics and other chemicals. Secondly, we examine what is meant by 'food' in this frame, asking some critical questions about ever more complex, globalised food systems. Thirdly, we draw attention to the multifunctionality of agricultural land, and the numerous factors that influence decisions about land use. In the fourth section, we discuss policy responses to the food vs. fuel debate, focusing on the European Union as the bloc provides one of the few markets to explicitly address the sustainability impacts of biofuels. In the final section, we draw some conclusions and call for a more nuanced debate on what land values.

2. Food versus fuel

In 2004, the Guardian columnist, George Monbiot, brought public attention to the potential impact of biofuels on global food supply in an opinion piece entitled 'Feeding cars, not people' (Monbiot, 2004). He argued that growing demand for biofuels would place additional pressure on food and agricultural systems that were already struggling to meet the needs of the 800 million food insecure; car owners would now be in competition with the food insecure in the developing world (Monbiot, 2004, 2007, 2012). This argument gained traction, and found support from others concerned that the superior purchasing power of car owners would trump poor people's demand for food, thus generating a food security crisis (Runger and Senaur, 2007; Vidal, 2007; Brown, 2009. See Figure 1).

Figure 1. The global food and fuel crisis.



Source: World Vision (2008)

Apparent evidence to support the food vs fuel argument began to emerge in 2007/08 with the rise in global food prices, which was accompanied by social unrest in several cities in the global South (Rosillo-Calle and Johnson, 2010; Thompson, 2012a). The actual contribution that biofuels made to the food price hikes has remained contested due to the complexity and uncertainty inherent in attempting to model the different factors at play, although most studies have found that biofuels were a contributing factor (Nuffield Council on Bioethics, 2009; Kretschmer et al., 2012; Zilberman et al., 2012; Zhang et al., 2013; De Gorter et al., 2015). Given that explicit aims of the agricultural development objective were to prop up food prices and create new markets for agricultural products (Tyner, 2007), and historical assessments of biofuels had stressed the potential for conflict with food production (Raman and Mohr, 2014), price rises were arguably foreseeable and therefore preventable. Since then, food prices have remained higher than the historical average (FAO, 2015), and biofuels remain an important factor.

However, food security and the issues underlying it are complex (Sen, 1982; Clancy, 2008; Thompson, 2012a). In a review of the evidence on the impact of the 2008 food price hikes on the poor, Compton et al. (2010) found that the crisis hit the poorest households hardest. The main impact of rising food prices was to increase the depth of poverty of already poor households, rather than increasing the poverty headcount. Although it could be argued that higher food prices benefit the rural poor at the expense of the urban poor, Compton et al. (2010) found that "many of the rural poor face constraints on land, labour or water which makes it difficult for them to produce a surplus" (p. vi). Therefore, food vs. fuel conflicts are likely to impact on both the urban poor who suffer from inflated prices for key foodstuffs, and the rural poor even in areas of surplus (Compton et al., 2010; Havlik et al., 2011; Thompson, 2012a). There is, however, only limited empirical evidence on the (distributional) impacts of biofuel production on local food security (Hodbod and Tomei, 2013; Locke and Henley, 2014).

In addition to the impacts on food prices, the food vs. fuel debate also encompasses the conversion of land from food to biofuel production. For example, Runge and Senauer (2007: no page) argue that 'in Southeast Asia, vast areas of tropical forest are being cleared and burned to plant oil palms destined for conversion to biodiesel' and such statements are widespread in critiques of biofuels. However, the actual proportion of, for example, palm oil entering biodiesel markets is uncertain; for instance, Obidzinski et al. (2012) report that only 1.3% of palm oil produced in Indonesia is used for biofuels. Further, and as we discuss below, planting and land use decisions are influenced by many factors, including climate, commodity futures, access to capital, and markets, values and knowledge. For many, the anticipated transition to second-generation biofuels offers a solution by disassociating biofuels from the negative impacts on food (e.g. Brown, 2009; Nuffield Council on Bioethics, 2009). While energy crops and residues do not compete with food markets, their production still requires land raising key questions about what land is and should be used for.

Food vs. fuel continues to be used by NGOs, the media and biofuel critics to draw attention to the potential impacts of biofuels on food prices (e.g. Carrington, 2011; Monbiot, 2012) and land use (e.g. GRAIN, 2013; Carrington, 2014). In 2012, for example, campaigns by ActionAid ('Food not Fuel') and Oxfam ('The Hunger Grains') were timed to coincide with a key vote by European Ministers on biofuels, and called for an end to the use of food-based crops as fuel (Kelly, 2012; ActionAid, 2013). While the evidence on the impact of the food vs. fuel debate on public opinion is limited (Thompson, 2012a; Ackrill and Kay, 2014), it is clear that the moral argument that food crops should not be used as fuel is persuasive and compelling. As Thompson (2012a: 344) argues, the food vs. fuel argument has established and demarcated a rhetorical space in which biofuels may be debated. In the sections that follow, we examine this space and draw attention to the complex issues obscured by this simplified frame.

3. Flex crops: multiple uses, multiple markets

Researchers have used the term 'flex crop' to refer to crops that have multiple uses that can be easily and flexibly interchanged (see for example, Borras Jr et al., 2012, 2013, 2015; Hunsberger, 2015; McKay et al., 2015). This term challenges a crucial assumption implicit within the food vs. fuel argument that a crop has a single utility; in other words, that a crop can be used for food or for fuel, but not for both. Indeed, this assumption overlooks the fact that many feedstocks are used in multiple

end markets, including direct human food consumption, for animal feed, in industrial applications, for bioplastics, and the generation of electricity (Borras Jr et al., 2012; Thompson, 2012a).

This material flexibility provides commodity suppliers with risk hedging options due to the multiple end uses which increase potential avenues of sale, and enhances the capacity to diversify the product portfolio. This enables these actors to address price volatility in world commodity markets (Borras Jr et al., 2015; Hunsberger, 2015). A key example of this material flexibility is the integrated biorefinery wherein the same plant produces multiple bio-based products, including food, energy and value-added products. The choice then is not between food and fuel, but rather what proportion will go to which end product and such flexing decisions will be influenced by multiple factors, including policy incentives, regulation, global oil and commodity prices, market access, ownership, and technology development (Borras Jr et al., 2015; McKay et al., 2015). For those concerned about the negative impacts of increased demand for biofuel, this flexibility represents a considerable challenge, since measuring the direct and indirect impacts on crop and land use, food prices and commodity markets is extremely complex.

The multiple uses and markets of flex crops, many of which are mainstream food commodities, questions the implicit assumption within the food vs. fuel debate that a crop has a single utility, as well as undermining a tacit presumption that these crops are grown with a specific market in mind. This may be true in certain cases, for example high oleic low linolenic oilseed rape is grown specifically for specialised food and bio-lubricant markets (Orson et al., 2008). However, overwhelmingly, the end markets will depend upon the (non)contractual arrangements that exist between the manager or owner of the farm/plantation, and the various merchant intermediaries and processors. Further research on the political economy of flex crops is urgently needed (Borras Jr et al., 2015; McKay et al., 2015).

4. Unpacking notions of 'food' in food vs. fuel

As discussed in Section 2, much of the power of the food vs. fuel argument resides in the notion that by choosing fuel, biofuel consumers are taking food from the mouths of those who are food insecure. However, as discussed above, many biofuel feedstocks are not staple crops, but rather are inputs into food processing. This raises the critical question of what is meant by 'food' in this debate. The common sense definition of 'food' that is generated by the food vs. fuel framing is that of staple foodstuffs. However, many biofuel crops may only loosely be thought of as food crops. To give some examples, although palm oil is important as a staple oil for household cooking across much of Asia and Africa, it is most likely to be used within non-staple luxury products such as confectionary, spreads, and baked goods (Alonso-Fradejas et al., 2015). In the US, the world's largest producer of maize – a staple food crop for many – most of the crop is used in livestock feed; it is also processed into a multitude of food and industrial products, including sweeteners, corn starch, beverages and fuel ethanol (USDA, 2015). The cartoon shown in Figure 2 draws attention to some of the multiple uses of maize.

Figure 2. Flex crops: ethanol wastes food

Source: Outside the Beltway (2011)

In the UK, bioethanol from wheat utilises wheat grown for animal feed markets, rather than wheat that would find its way into a staple food, such as bread (HGCA, 2010). Thus, the foodstuff conjured in the imagination when we think of wheat has yet to be directly affected by the production of biofuel. One further example is provided by sugarcane – the principle feedstock of the highly successful Brazilian ethanol industry. As concern grows about the obesity crisis, attention has turned to the impacts of sugar on human health. It has been argued that the effect of sugar consumption on the human body is similar to that of alcohol and tobacco, and should be similarly regulated (Lustig et al., 2012; BMA, 2015).

While clearly 'food' crops, it is unclear how these examples fit with the current framing of the issue as one of food vs. fuel. Although few would argue for the conversion of land from the production of staple crops, such as potatoes or barley, to the cultivation of biofuel feedstocks, what about land dedicated to the production of sugarcane used in the processed food industry? Is this a better or worse use than using land to produce tobacco or flowers or fuel? Further, who makes the decisions about the uses to which land is put, and what factors influence this decision making?

5. The multifunctionality of land

This raises a further crucial question about what land is used for. Food vs. fuel has so far framed the answer to this complex, value laden, historically contingent and geographically constrained question, as a binary choice. In other words, we can either have land that grows food crops to feed the world's poor or we can have biofuel feedstocks to power the motorised vehicles of the industrialised global North. By focusing on biofuels as the sole driver of land use change and the associated impacts on livelihoods and food security, food vs. fuel frame has masked the contribution of other important and

interconnected factors. This raises questions about whether the seemingly straightforward choice presented by food vs. fuel, between one land use and another, reflects how land *is* used.

Land is a highly flexible and multifunctional resource. Potentially providing a range of services, either due to active management (e.g. farming) or passively, due to inherent capacities of the land (e.g. peatland as a carbon sink). Yet, this multifunctionality changes depending on the scale of analysis. At a landscape or floodplain level, land may contribute or alleviate the risk of flooding due to the ways in which it holds, directs or sheds water. At the field level, the field is composed of multiple components: the hedgerows, stone walls, margins, and field trees providing habitats and corridors, soil erosion prevention and biodiversity. The majority of the field may be dominated by a single crop, but the field is still a habitat for the attendant 'weed' and 'pest' species. A closer examination of how land is used suggests that designation of land into broad categories masks the potential minutiae of land multifunctionality. Equally, arable lands are often embedded within systems of crop rotation, meaning the function of a singular parcel of land changes on an annual basis. Land use is not static over time, and although change occurs on an annual basis it also changes over timeframes spanning millennia, due to human interventions and natural patterns of change.

How land is used is contingent on a set of complex interactions. Interactions between the historical legacy, the physical characteristics, and the geographical location of the land, alongside ownership, legal frameworks, the societal and cultural values associated with 'good' land management, and the political and regulatory environment, all shape how land is used (Burton, 2004). Organic, industrial, monoculture, mixed cropping systems, inter-cropping systems, subsistence, commercial, outgrower schemes, family, contract, tenanted farming, all represent different configurations of circumstances, markets, values, and ownership arrangements. Further, it is also important to recognise the role of political decisions, which are often crucial in changing how land is used. In this regard, biofuels is the latest in a long line of policy decisions to have implications on land use, albeit on an unprecedented and global scale. Indeed, it could be argued that the contemporary situation, in which significant land is not required to service the energy needs of society, is something of an historical anomaly. For example, managing land for woodfuel is one of the longest standing means of producing biomass to meet the energy needs of human society (Lewis, 1981).

6. The European Union response to food vs. fuel

The EU has positioned itself as a global leader on the mitigation of anthropogenic climate change and the adoption of targets for the use of renewable fuels in the transport sector has been a key component of the bloc's renewable energy policy. The EU is also one of the few global biofuel markets to explicitly address the sustainability impacts of biofuels (Rosillo-Calle and Johnson, 2010; Ackrill and Kay, 2014), and in this section we examine the EU response to the food vs. fuel debate.

Within the EU, biofuels has been approached within policy as a renewable (low carbon) energy, energy security and fuel quality issue. In 2000, the European Commission's Green Paper '*Towards a European strategy for the security of energy supply*' placed biofuels firmly in the energy spotlight, positioned in the context of securing energy supply whilst also responding to climate change. However, despite a legacy of repeated signposting in the 1980s and 1990s of food insecurity being a potential consequence of utilising biomass (food and non-food) for fuel (see Lewis, 1981; Ramsay, 1985; Hall,

1991; Hall et al., 1992; Rosillo-Calle and Hall, 1992), the concerns over negative consequences mooted within the Commission's (2002) report on the green paper and in regards to biofuels focused on the environmental risks if biofuel production stimulated a more 'industrialised, polluting agriculture' (p. 27) and some scepticism over purported carbon savings of biofuels (see p. 26). The Green Paper and the consultation report directly informed the formulation of the 2003 Biofuels Directive and established the trajectory within which the 2009 Renewable Energy Directive emerged.

The lack of food security considerations is indicative of three factors. Firstly, the policy formulation process being embedded in energy and climate change concerns with an absence of clear connections to EU agricultural policy and its strategic objectives. For example, biofuels are not embedded within the Common Agricultural Policy, which has not engaged with promoting biofuel or biomass energy crops in a substantive or long lasting way. Secondly, food security was not then a concern of the EU; the bloc was just emerging from a period of extended agricultural surplus with its associated environmental and fiscal issues of overproduction and agricultural intensification. Thirdly, a prevailing set of assumptions of a biofuel industry contained in national and inter-EU spaces of production. Models of a potential future biofuel system have persistently focused on the resources available within certain EU regions and national spaces (see Clifton-Brown et al., 2004; Slade et al., 2010; Hellman and Verburg, 2011). This is partly informed by the way in which the EU and its member states are imagined to represent a cohesive competitive unit (Levidow et al., 2012).

Despite the emergence of food vs. fuel as a major point of controversy, the policy responses have been drawn out. The 2009 Renewable Energy Directive only included the requirement to report every two years on the 'availability of foodstuffs at affordable prices' (EC, 2009: L 140/38). In 2012, the Commission proposed that food based biofuels be limited to 5% by energy of EU transport fuels and half the target established in the Renewable Energy Directive (EC, 2012). The most recent iteration of these proposals has seen a compromise between the European Council and Parliament with regards to the percentage of biofuels to be blended on the basis of energy use. Initially the council backed 7% and whilst the Parliament's environmental committee proposed a 6% cap (EurActiv, 2015a). The final compromise agreement was passed by the European Parliament on the 14th April 2015 and allows for a 7% cap for food based biofuels with individual member states able to choose a lower percentage if they so wish (EurActiv, 2015b). The deadline for member states to transpose this agreement into national legislation is 2017, a decade after food spikes initially drove food vs. fuel concerns into the spotlight.

7. Conclusions

Food vs. fuel delivers an emotive and powerful message, one readily captured by the media and which resonates with the public imagination. The argument creates clear victims and culprits, winners and losers. It also provides a simple solution: no more biofuels. However, reality is rarely so simple and this paper has drawn attention to three interrelated issues that complicate this narrative. Firstly, food vs. fuel does not address the multiple uses of crops and their by-products. Biofuel feedstocks are presented as single products, yet all first generation feedstocks can be and are used in multiple markets. The material flexibility of these 'flex crops' links to the second issue, what is meant by 'food'? The notion of 'food' embodied in food vs. fuel conjures an image of crops that will directly consumed by humans (see also Figures 1 and 2). However, as discussed, while some crop varieties may be

consumed directly, others must be processed before they enter the food chain, whether as food or feed; how many people would recognise corn starch, rapeseed oil or refined sugar as the 'food' so effectively evoked by food vs fuel? 'Food' as an imagined category is a gross simplification of the realities of food production, processing, and consumption in the 21st century. Finally, agricultural land is used for far more than just the production of food, and this is not recognised by the food vs. fuel argument. Land is a highly flexible and multifunctional resource, providing not just food, but a range of other products (e.g. feed, fuel, fertilisers, fibre, flowers, drugs) as well as biodiversity, livelihoods, cultural and existence value, and other ecosystem services. The food vs. fuel argument does not touch on these other uses of this complex and highly valuable resource, nor does it acknowledge the importance of the values of those who manage land.

As Ackrill and Kay (2014) argue, the food vs. fuel argument resulted from the complexity of and interlinkages between energy and food markets. Yet this frame has reduced these multifaceted systems, limiting the debate and concealing a more complex reality. Perhaps what food vs. fuel does most effectively is highlight the negative impacts of our consumption, forcing us to face the social priorities reflected by the apparent choice between food and fuel (Thompson, 2012a). However, even if the demand for biofuel disappears, the issues that the food vs. fuel debate has raised will not. A moratorium would not address the need for land to meet growing demand for food, feed, energy, fibre and fertiliser, nor would it tackle our consumption patterns. As we have argued in this paper, these issues cannot and should not be addressed through biofuels policy alone. 'What is land for?' remains a poignant question that has suffused this paper; it is time for more nuanced a debate about the multitude of ways in which agricultural land and produce is used, valued, by whom and for whom.

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