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A Comprehensive Evaluation of the EU's Biofuel Policy – from Biofuels to Agrofuels

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Abstract

During a time in which the subject of climate change is deemed high on the list of priorities of many governments, it is important to assess to what extent policies in this field are achieving meaningful results. The link between energy usage and global warming is clear and today in the European Union the use of renewable resources is being promoted more than ever before. The move towards a renewables based economy has clear benefits over a fossil fuel based one with regards to climate change and the environment, however if the implementation of renewables is not monitored and regulated then this is not a given by any means. Of the renewable resources, bioenergy has a high level of importance in the EU. For this reason, this paper will make a comprehensive evaluation of the EU's biofuel policy in order to assess what the driving forces behind the regulation of this resource are, and how they affect to what extent it is successful or not. In order to do this, firstly the impacts of current EU bioenergy consumption will be assessed, to determine whether it is achieving the stated and desired climate goals or not. Findings will show that in fact the current formulation of Europe's Renewable Strategy creates pressure to meet binding targets for renewable usage and the resultant rapid increase in the demand for bioenergy has caused a number of negative social and ecological impacts to arise. Therefore in light of this, the current systems in place at the EU level meant to regulate the use of bioenergy and ensure it is implemented in a sustainable way will be critically analysed in order to find out how such negative impacts have been able to occur. The final section will then look into the driving forces responsible for regulation of this kind through a case study of Germany and Indonesia.

Keywords: European Union energy policy, agrofuel, biofuel, renewable energy, sustainability criteria

JEL Codes: Q16, Q28, Q21, Q56, F23, K32

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1. Introduction

The Dutch scientist, Paul J. Crutzen, claims that the impacts of human activities on the Earth have pushed it out of the Holocene and into a new era known as the Anthropocene in which humans are the dominant force driving environmental change (Crutzen, 2002; Steffen et al., 2007). Rockström et al. (2009) identified nine planetary boundaries which cannot be breached without "undesirable outcomes" (2009:6). They reported that already in 2009, three of the nine had already been breached[1], with others at risk of being breached in the very near future (2009:23). Jackson (2010) also speaks of the need to live within a certain set of "limits [which] are established not by us, but by the ecology and resources of a finite planet" (2010:94).

Energy plays a central role in the current climate change debate, if positive and meaningful changes are to be made to ensure further planetary boundaries and limits are not breached, then in the short and medium term as well as in the long term renewable energies will play an important role (Jackson, 2010:58-59). However the usage of renewables must be monitored and regulated in order to ensure benefits are actualised, if left unregulated the impacts on the environment can in some cases be worse than those arising from the use of fossil fuels.

Renewable energy is an important resource for the EU as it tries to shift away from a heavy reliance on fossil fuels and utilise a higher percentage of energy from renewable resources in order to meet targets and regulations set out in their own policy documents. Of the renewable resources available to Europe, by far the most important is biomass (Bentsen & Felby, 2012; Giuntoli et al., 2016; Ladanai & Vinterbäck, 2009; AEBIOM, 2015; EC, 2014a). An assessment of the current EU agenda in the field of renewable energy is therefore necessary, a focus will be given to the bioenergy sector as this is the fastest growing and most important form of renewable energy in Europe (EC, 2014a; Bentsen & Felby, 2012; Bowyer et al., 2012) and in its current implementation is also very problematic and in need of a serious reassessment, as this paper will demonstrate.

The term 'agrofuel' will be used throughout the rest of the paper in place of 'biofuel' on the basis that the prefix 'bio' is misleading and masks the negativity associated with the fuel. The term 'agrofuel' refers more specifically to fuel which is created from plants and their products that are grown through agriculture in an intensive and industrial way (Econexus et al., 2007), and as this paper will show reflects the true nature of the fuel being used by the EU.

This paper aims to answer two specific research questions, firstly, *what are the social and ecological impacts of the EU's agrofuel policy, both in the EU and in agrofuel exporting countries?* And secondly, *which methods are in place to avoid or minimise such impacts and how appropriate are they?* This paper also tries to provide a comprehensive overview of the main driving forces behind the EU's biofuel policy, and what affect these forces have had on the social and ecological impacts occurring as a result of such a policy.

2. Analysis of the EU's Energy Strategy

Bioenergy as a Sustainable Resource

Much of the rationale for promoting bioenergy as a sustainable resource in the EU rests on the assumption that it is low carbon, reduces GHG emissions and therefore contributes to climate

[1] Including climate change, rate of biodiversity loss and changes to the global nitrogen cycle.

change mitigation whilst being so called 'environmentally friendly'. The original arguments put forward by the EU for the inclusion of agrofuels as a renewable energy resource seemed logical at first glance. If the crops used to produce agrofuels are managed in a sustainable way then it is plausible that the CO_2 which is emitted when the fuel is burned to produce energy should be offset by what is absorbed by new crops which are planted. The point is that using crops for fuels *can* be carbon neutral, but whether it is in reality is a different story. As demand increases rapidly the supply of waste products (the most sustainable source of agrofuel) is not large enough to match it, so land gets taken over by plantations that grow energy crops in order to keep up with the demand. Agrofuels were boasted as not only addressing climate change issues but also helping to develop rural communities in developing countries where production of crops for agrofuels is often located (Franco et al., 2010:667). "Because agrofuels recycle atmospheric carbon dioxide, they reduce greenhouse gas emissions relative to petroleum fuels; however, fossil fuel energy inputs used in the agrofuel production lifecycle lower the GHG mitigation potential of agrofuels" (Naylor et al., 2007:36). This important role of fossil fuels in the production of agrofuels was also not considered.

Such arguments are now being criticised by scientists as being an oversimplification. In reality, many factors affect to what extent this process is carbon neutral, for example what type of crops are used, how fast they grow and what type of land they are grown on (Bowyer et al., 2012). It is now widely believed that the time lag in the reabsorption of CO_2 can in fact run over many decades and sometimes even centuries. As noted by Rockström (2009), during the time which these excess emissions reside in the atmosphere the adverse effects which they cause may overstep planetary boundaries before they can be reabsorbed later, hence when this reabsorption does finally occur it is possible that it is too late and the damage has already occurred.

The creation of mandatory targets which increases demand of agrofuels has two effects on the production of biomass, firstly within the EU, it expands from small scale to large scale and secondly dependence on imports of biomass resources increases as the EU cannot produce enough domestically to meet demand (Levidow, 2012). The growing scale of production and the increasing amount of imports has the effect of reducing the sustainability of the resource. All arguments in favour of it being sustainable may in practice be true if production remained on local and smaller scales however as soon as resources are imported and production commercialised such theoretical benefits either become smaller or cease to exist all together.

European Agrofuel Supplies

EU ethanol is produced mainly in France, Germany, the Benelux countries, the UK and Spain. Production capacity quadrupled between 2006 and 2013, but was expected to remain stable for 2015 and 2016 in part due to the cap on food based bioethanol[2]. In the EU, bioethanol is produced primarily from wheat, corn and sugar beet (Flach et al., 2015). Biodiesel is far more commonly used than ethanol, representing almost 80% of the total transport agrofuels market. The same countries that dominate in bioethanol production remain dominant in the production of biodiesel[3]. Production capacity experienced rapid growth from 2006 to 2009 when it quadrupled. The most widely used feedstock is rapeseed oil which made up 55% of the total in 2014 (Flach et al., 2015).

[2] This will be explained later on in the paper.
[3] Germany, France and the Benelux countries are at the top.

However, figures on EU production can easily be misleading as it does not just import ethanol and biodiesel in their processed forms but also import the feedstocks in their primary form, such as seeds or oil which are then transformed into agrofuels within the EU. This counts towards the figure of agrofuels being produced in the EU, however the feedstocks are still imported. Finding figures that reflect the true amount of imports including all feedstocks and oils used for agrofuel production in the EU is difficult. However, according to Flach et al. (2015) "a significant share of domestically produced biodiesel feedstock is crushed from imported oilseeds" (2015:25). Hence, in spite of the EU being the leading biodiesel producer, it should be kept in mind that a large majority of the feedstocks that are used to produce this biodiesel are imported, primarily from South-East Asia (Pichler, 2011).

Even if it is the case that domestic feedstocks are used for the production of agrofuels, often this can result in 'indirect imports' as domestic produce is used entirely to produce agrofuels, the amount that was previously used for food production now has to be imported (Pichler, 2011:5). According to the EU, this is the case for European biodiesel production which is almost produced entirely from rapeseed oil grown in the EU, therefore the amount that was used for food production is replaced by imported vegetable oil and oilseeds, meaning that indirect imports increase as a result. In a study commissioned by the European Commission research centre, when indirect and direct imports for biodiesel production in the EU are added, they account for 50% of total biodiesel production (assuming 30% from second generation agrofuels by 2020), and without the contribution from second generation agrofuels, this amounts to approximately 80% (Edwards et al., 2008:28). The second figure seems more realistic as projections of 30% from second generation agrofuels by 2020 is somewhat optimistic (Mitchell, 2008).

3. Analysing the Policy Approach of the EU and its Impacts

It is necessary to have a clear conception of who the main actors in the agrofuel debate are and to see which actors were on which side in order to determine why the EU's agrofuel policy and its sustainability criteria are somewhat contentious with regards to sustainability. As with any ongoing debate there is the pro-agrofuel side and those who were against the policy from the outset. The debate relies primarily on two contesting discourses, those who are pro-agrofuel follow the aptly named "sustainable managerial discourse" (Dietz et al., 2015:4) which relies heavily upon the arguments of agrofuel policies pioneering climate change and rural development. Those who are against follow more of a "populist and critical discourse" (Dietz et al., 2015:4) which essentially follows the opposite argumentation, that the agrofuel project is in fact worsening climate change, food security and the lives of rural populations in the Global South.

In order to have a deeper understanding of Europe's agrofuel policy and to question its driving forces, it is necessary to have a clear comprehension of the assumptions upon which it stands. Although overtime arguments in favour of biofuels have slightly changed and the meanings and prioritisation of which are most important may also have shifted slightly, the three general arguments upon which the promotion of biofuels is based remains essentially the same; environmental protection[4], increased energy security and positive rural development in countries

[4] Mainly through GHG emission savings.

which are producing biofuel feedstocks. This is made clear in a number of EU documents and elsewhere (BIOFRAC, 2006; EC, 2001, 2006, 2014b, 2015; Directive 2003/30/EC).

One of the main bodies set up by the EU in 2005 which was created by the Commission's Directorate-General (DG) for Research was the Biofuels Research Advisory Council (BIOFRAC[5]) whose purpose was to inform the EU policy on agrofuels. In their report from 2006 (BIOFRAC, 2006:3), their aim was to "address all relevant issues and provide a vision and outline strategy, with emphasis on RTD&D, to increase, markedly, biofuels production and use in the EU". Already emphasis was given to the business sector and the role of technological innovation through continued research and development. BIOFRAC's vision was that by 2030, 25% of transport fuels would come from agrofuels which they claimed would all be produced "using sustainable and innovative technologies, creating opportunities for biomass providers, biofuel producers and the automotive industry" (2006:3). Such statements already make clear who the target of the policy was even in 2006, the attention to and important role of businesses and companies throughout the document is clear.

However, BIOFRAC was replaced within a few years by a larger and longer-term body known as the European Biofuel Technology Platform (EBFTP) (Franco, 2010:663). Here, the influence of corporations becomes even more apparent. In 2010, of the twenty-three members of the steering committee of EBFTP, four were from the oil sector with the Chair of the Committee from Total[6], four were from the automotive sector from companies including Volvo and Volkswagen, three were from large agrofuel organisations or companies and five from the biotech sector, which makes clear the influence of large corporations in the body which was providing advice and recommendations to the EU (Franco, 2010:664). For these powerful sectors, agrofuels are seen as the perfect solution to meeting emission targets whilst still being able to leave the current transport system untouched and even prolong its life expectancy. Rather than the necessary scaling back of the sector, by using agrofuels, the oil and automotive sectors are able to continue in an almost business as usual fashion (Pye, 2009:86). Even today, the same committee although with different members is still comprised primarily of representatives from the forestry, oil, biotech and automotive industries with multinational companies such as Repsol, DONG, Total, Neste and Volvo still having company representatives on the board (EBFTP, 2016). It should be noted that it is these powerful connections between the oil and automotive industry and the EU that allowed this high level of influence to arise, and to result in pro-agrofuel legislation being passed (Dietz et al, 2015).

Many EU member state governments have also aided the European Commission in the pro-agrofuel debate and have been seen to be increasingly intervening in the production of agrofuels in developing countries. Those member states with more advanced technology, for example, are able to provide technical assistance to those countries with abundant feedstocks or land for growing crops but perhaps less developed technology, often in exchange for import deals (Dauvergne & Neville, 2009). In countries in the Global South where the conditions are suitable to grow large amounts of feedstock, governments perceive the agrofuel market as a means through which to pursue a developmental agenda, hence cooperation with governments and companies in the Global North is often well received (Dietz et al., 2015:2). According to Dauvergne and Neville (2009) this shift of interest of Northern European governments towards ones in the Global South will result in

[5] Essentially a lobby group in place to inform EU policy on agrofuels.
[6] The world's fourth ranked oil and gas company.

the reinforcement of resource exploitation which has been seen previously, as well as perhaps an increase in South-South trade. Such initiatives aimed at developing new technologies and technology sharing can risk creating a situation where the incentives for profits in the short term outweigh environmental and social sustainability in the longer term (2009:1088) as is the case in the agrofuels revolution.

Those who placed themselves against agrofuel policy tended to be mainly civil society groups, charities and organisations who protested the policy, primarily based on concerns over the environmental and societal impacts. Such groups questioned the central foundations of the policy, attacking the likelihood of greenhouse gas (GHG) emission reductions which they argued could even be negative due to other environmental issues such as deforestation, biodiversity loss, commercial farming techniques and land-use changes, and which they claimed were not taken into account by the policy (Franco et al., 2010). These groups are often involved in campaigning or lobbying, one example being a project supported by BirdLife Europe, ActionAid, Greenpeace European Unit and others (BirdLife Europe et al., 2010) which culminated in the release of a document called *Driving to Destruction*, in which Europe's agrofuels policy was slammed for the impacts on land use and it's carbon neutrality questioned.

3.1. Investigating the Social & Ecological Impacts of Agrofuels

Much of the literature on the topic of agrofuels weighs in on the debate of whether the overall impacts of agrofuel consumption are positive or negative. While in the EU, agrofuels may appear to many as the answer to a number of the problems associated with fossil fuels and one of the ways through which to mitigate climate change, their import has been associated with unforeseen impacts on both the environment and people, not only those involved in their production, but in some cases also the wider community through the effect on food prices. The debate on agrofuels has focused on many different issues, but the following have been of central importance and will be focused upon in this paper; environmental issues[7] and the question over whether GHG emission reductions are experienced in practice. The second part will focus on the social issues related to increased competition for crop land and the resultant impact on food security and labour conditions.

Environmental Impacts

Many of the initial studies into the carbon neutrality of agrofuels that were used to argue that the resource was environmentally friendly (Farrell et al., 2006; Macedo et al., 2004; EC, 2006) use life-cycle assessments that compare the GHG emissions from each step of producing agrofuels or the fossil fuel equivalent. Steps include the growing or mining of the resource, the process of turning that into a fuel, and then the combustion of the fuel. Even if the emissions from the second and third steps are equal, the argument was that during the first stage whilst the feedstock is being grown, it is absorbing CO_2 from the atmosphere, whereas the mining of crude oil will result in GHG emissions, therefore the net GHG emissions from the production of agrofuels are less relative to fossil fuels and should also be positive (Searchinger et al., 2008:1238; Reinhardt et al., 2008).

Studies using this type of assessment were then critiqued on the basis that accounting of this kind was biased as it only accounted for the carbon benefits (i.e. counting the carbon which is absorbed

[7] Including land-use change (also ILUC), with related deforestation and biodiversity loss.

during growth) of using the land to produce agrofuel crops and failed to include the carbon costs of using the land (carbon storage and sequestration which is sacrificed when land-use is changed from its previous use). Scholars then began conducting studies which accounted for these negative carbon costs and came to very different results.

When discussing the land-use changes associated with increased agrofuel production, it is necessary to look at the pioneering work in the field by Farigone et al. (2008) and Searchinger et al. (2008) who were some of the first scholars to take into account the GHG emissions resulting from land-use change. As demand for agrofuels increases, more land is needed in order to increase production in line with demand. Hence previously undisturbed land is then used for agrofuel feedstock production and the land needs to be cleared either through burning or decomposition. The total stock of carbon contained within soils and plant biomass is greater than the total stock held in the atmosphere, hence it is problematic when this carbon is released through land conversion.

This amount of CO_2 released during land conversion is what Farigone et al. refer to as the "carbon debt" (2008:1236). It is possible that over time the agrofuels produced from this converted land can 'pay back' the debt but only if their production and then combustion have final net GHG emissions that are less than the fossil fuels they replaced. Farigone et al. (2008) in their study[8], find that by converting native habitats to land for agrofuel production large carbon debts are made, which would not be repaid by the agrofuels for "decades or centuries" (2008:1237). For example, the carbon debt from producing soy beans in the Brazilian Amazon for biodiesel would require approximately 320 years to pay back compared with the GHG emissions from petroleum diesel. Hence they conclude from their findings that when agrofuels are produced on land that has been converted from its natural state, these so called 'carbon neutral' and 'environmentally friendly' resources could in fact be emitting larger amounts of GHG emissions, for a much longer time period than the fossil fuels that they replace (2008:1237). In a similar study[9], Beer et al. (2007) found that the results of GHG emissions calculations change from 80% improvement to over -800% if the land was previously rainforest and up to -2000% if it was peat forest, due to the amount of carbon stored in the soil and vegetation. This makes clear the significant impact that including or excluding land-use change can have upon results.

Searchinger et al.[10] (2008) follow a similar aim to Farigone et al. (2008) looking to calculate the GHG emissions from land-use change in the production of agrofuels in the US. Their results find that the production of corn-based ethanol resulted in almost double the amount of GHG emissions over 30 years and increased emissions for 167 years (2008:1238). Both Searchinger et al. (2008) and Farigone et al. (2008) conclude by highlighting the value of agrofuel production from waste products as this is the only sure way of avoiding increased emissions as a result of land-use change (Searchinger at al., 2008:1240; Farigone et al., 2008:1237).

[8] The study looks at six different cases of land converted for agrofuels feedstock production and calculates how large the agrofuel debts are from these conversions and how many years are needed to repay the debt. They look at three cases in Brazil (Amazon and Cerrado where land was converted for soybeans (biodiesel) and sugarcane (ethanol)), one in Indonesia and Malaysia (peatland tropical rainforest to palm biodiesel production) and also in the US (grassland to corn ethanol) (Farigone et al., 2008:1236). These cases cover the main areas of production for the vast majority of agrofuels, and, although these fuels are not directly produced in the EU, as the EU import from these countries they are also responsible for the impacts.

[9] When comparing a base case scenario between cropland from cleared rainforest and peat forest growing palm oil.

[10] The authors use a worldwide agricultural model to estimate the emissions resulting from land-use change in the US corn-based ethanol industry.

Following on from these initial ground-breaking papers, a large number of studies (Al-Riffai et al., 2010; Bringezu et al., 2012; Dicks et al., 2009; Fabiosa et al., 2010; Gurgel et al., 2008; Hiederer et al., 2010; Laborde, 2011) over the following years went on to examine the impact of the expansion of the agrofuels market on both direct and indirect land-use change at both national and international levels and how to quantify and assess them. From such studies the importance of also including indirect land-use changes (ILUC) became apparent. Additional land needed for the production of agrofuel feedstocks is supplied either directly by conversion of other types of land e.g. forest or grassland into crop land or it is supplied indirectly through reallocating the existing crop lands already producing other types of crops e.g. cotton, rice, fruit or vegetables to agrofuel crop production. This means that the production of the original crop is displaced and production must now increase elsewhere on other land, therefore this reallocation creates ILUC (Steinbuks & Timilsina, 2014:91,99). This creates a problem as producers can ensure agrofuel feedstocks meet the sustainability criteria as they are grown on land that was already used for agricultural crops, then land which should not be used under the sustainability criteria can now be used to grow the agricultural crops which have been displaced, so the environmental impact of the ILUC is in effect the same as directly clearing land to grow agrofuel feedstocks.

Many scientists have tried to quantify these ILUC, however a consensus on the issue is still missing. The main reason for such differentiated results across the literature with regards to the GHG emissions associated with ILUC is down to the varying approaches used, different models for estimation are used in different studies and there still remains a high value of uncertainty in trying to precisely calculate ILUC (Timilsina & Mevel, 2014:114). An example of one study which incorporates ILUC is by Laborde (2011) who found that ILUC in fact eliminate more than 60% of the direct GHG emission savings estimated by the EU agrofuels policy for 2020. Depending on whether ILUC are taken into consideration or not leads to vastly varying results, when excluded it allows for highly positive results.

Due to the lack of consensus across the scientific and academic community, the EU were able to avoid addressing the issue seriously until 2012 when the Commission made a proposal to the Parliament to make some amendments to the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD) in order to take into account the effects of ILUC (EC, 2012a). The impact assessment which was carried out still concluded however that “despite better understanding [of ILUC, they are still] vulnerable to the modeling framework and assumptions made” (EC, 2012b:67). The assessment also still sees the main problem as the GHG emissions from ILUC and does not consider any of the social aspects of land. Finally in April 2015, the European Parliament approved a reform of RED, the main change was a cap of 7% on the amount of agrofuels from agriculture that can make up the 10% target for renewable fuels in transport, however this has still been criticised as being weak.

With the cap still too high at 7% and the decision not to include a methodology to quantify ILUC left out, it can be expected to make only a minor impact. As the amount of crop-based agrofuels being consumed in the EU is still slightly below 7%, this means that even though a cap is now present, expansion can still continue, therefore only minimal changes in the extent of the impacts are likely to be seen. Many green Members of the European Parliament (MEPs) expressed their disappointment with the final amendments, one Dutch MEP who was interviewed at the time, summarised the general feelings succinctly saying the legislation “falls far short of what is required to address the myriad of problems with the EU's agrofuel policy" (Keating, 2015). As expected any significant changes were lobbied against hard by the existing agrofuels industry as well as the oil and automotive industries (Keating, 2015).

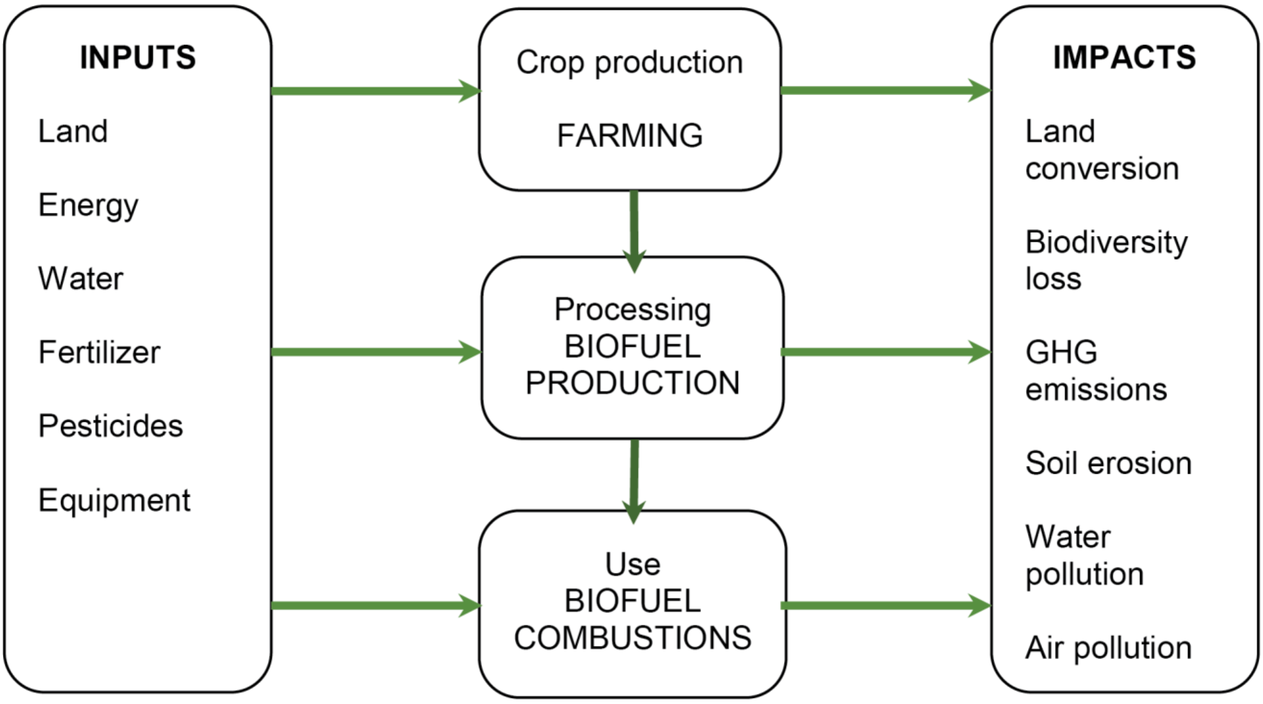
One recent study carried out by the Institute for European Environmental Policy (IEEP) analyses the impacts of Europe's increasing agrofuel consumption on land use and GHG emissions by studying projections from the most recently published National Renewable Energy Action Plans (NREAPs), which member states are required to submit. The study found that member state national-level plans for energy and transport show that consumption of agrofuels in Europe is forecast to continue increasing, by 2020 agrofuels will provide up to 9.5% of the total energy in transport, with 92% of these fuels being produced from food crops. In order to meet this demand, the amount of cultivated agricultural land available globally will have to expand by up to 69,000 km^2. The report calculates that the net GHG emissions from agrofuels could reach as high as 56 million tonnes (Mt) of extra CO_2 per year. When comparing this to the requirements set out in RED which specify that agrofuels should produce 35% to 50% less GHG emissions than fossil fuels, the IEEP report concludes that when land-use impacts are also considered in the calculations, the extra agrofuels that will come to the EU market to meet the increased demand will be on average 81% to 167% worse for the climate than their fossil fuel equivalents (Bowyer, 2011:2).

Much of the literature also criticises in general the notion and methods of carbon accounting for agrofuels (Bringezu et al., 2009a; 2012; Haberl et al., 2012; Laborde, 2011; Searchinger, 2008). Not only are there issues with regards to land-use change but, as argued by Haberl et al. (2012) there are very high risks of underestimating the GHG emissions across the whole supply chain of bioenergy. An important factor brought to light by Bringezu et al. (2012) is the impact the importing of agrofuels and biomass can have on the environment. When resources have to be imported an extra step is then added to the process of production in the form of transportation usually by shipment which adds to the overall GHG emissions. As the EU member states continue to increase their consumption of agrofuels to meet targets imports will continue to rise. The IEEP study calculated that by 2020, at the very least 44% of bioethanol and 36% of biodiesel[11] are expected to be imported to the EU (Bowyer, 2011:2).

Bringezu et al. (2009a) summarise effectively the extent of the environmental impacts of both the production and consumption of agrofuels (see Figure one). Increased production results in rising pressure on the inputs as more and more are needed to meet rising demand. Some crops which are used as agrofuel feedstocks are also associated with a higher usage of pesticides and fertilisers, which have their own negative impacts on the soil and its acidity (Rosillio-Calle & Tschirley, 2010:17). Although much of the literature surrounding the topic focuses primarily on GHG accounting methods and land-use change, other impacts including biodiversity loss, deforestation and water pollution have been the focus of protests and papers written by NGOs and charities who have become another group of actors involved in the agrofuels debate (BirdLife Europe et al., 2010; Econexus et al., 2007).

[11] The actual levels of feedstocks to be imported are expected to be even higher as member states do not make clear in their NREAPs whether imports refer to processed agrofuels or include also the feedstocks which are then used to produce domestic agrofuels.

***Figure 1** - General Agrofuel Pathways with Inputs and Environmental Impacts*



Source: Bringezu et al., 2009a

One of the most comprehensive and up-to-date studies funded by the European Commission, which was originally kept secret[12] found that the harm to the environment resulting from the EU's consumption of agrofuels could be deemed as "significant" (Al-Riffai et al., 2010:11) if consumption rises higher than 5.6%. If consumption is greater than 5.6%, the study found that emissions resulting from ILUC can "rapidly increase and erode the environmental sustainability of agrofuels" (Al-Riffai et al., 2010:11). Considering the target for EU consumption of agrofuels by 2020 is 10%[13], and current consumption was already at 5.4% in 2013 (Eurostat, 2015), it is extremely likely that this limit will be exceeded.

The report made two overly optimistic assumptions which the EU have based targets on, firstly that almost half of the 10% target would be met from other sources such as second generation agrofuels and electric cars powered by electricity from renewable sources. As previously mentioned, the production of technology surrounding second generation agrofuels is still in its infancy today (Naik et al., 2010), and the contribution of electric cars to the 10% target was exaggerated in forecasts which predicted it would represent 20% of new car sales (Harrison & Dunmore, 2010)[14]. The second was that only 45% of the total amount of agrofuels consumed would come from biodiesel which has worse ILUC effects than bioethanol, the contribution therefore of ethanol which is the greener of the two is over exaggerated as being up to 55%. In 2013 already, the EU was consuming only 6,520 million litres of bioethanol compared with 12,220 million litres of biodiesel, almost double (Flach et al., 2014). Some estimates even suggested that biodiesel would make up 79% of

[12] Only released when international news agency *Reuters* used freedom of information laws to gain access (Harrison, 2010).
[13] Even now with the cap of agrofuels from agricultural crops at 7%.
[14] This figure is even greater than that forecast by the car industry itself (Harrison & Dunmore, 2010).

the total amount of agrofuels used in EU transport and put bioethanol at only 19.9%[15] by 2013 (EurObserv'ER, 2014:8). The report did express however that the mix between ethanol and biodiesel is very important as, depending on the ratio, the land-use effects and the resultant sustainability can be very different (Al-Riffai et al., 2010:71).

Social Impacts

The central debate related to the social impacts of agrofuel consumption is focused on the so called 'food vs. fuel' issue. The rapidly increasing demand for agrofuels attracted the most attention and sparked debates around the resource during 2008 when increasing agricultural crop prices came to a head in what was defined as a global food crisis. Many pointed to agrofuels as one of the main contributors to this crisis, as the rapidly increasing global demand had resulted in large amounts of land (and other inputs including water and fertilisers) that had previously been used to grow food crops were instead used to grow agrofuel feedstock, the result was a distortion in the price of agricultural commodities which had been stable and fairly moderate for many years previous to 2008 (Basu, 2014:6). The majority of agrofuels consumed today are made from crops which are also food crops so not only is there competition for land but there is direct competition for the end-use of the crop i.e. whether it is used for fuel or as food (Bringezu et al., 2009a). The most popular agricultural crops used as feedstocks for agrofuels[16] are the crops which make up a large proportion of the diets of the world's poorest (Naylor et al., 2007:42). The Food and Agricultural Organization (FAO) (2008) also focused on the issues of land competition for crops and stated that as a result of increasing competition the prices of food have also been affected. According to Grethe et al. (2013), the agrofuel policy of the EU has been directly responsible for price increases amounting to 16% for plant oils, 10% for oil seeds and an average increase of 2.6% in the global crop price (2013:7).

The social issue related to increasing food prices is that it is the poorest households who are most vulnerable to changes in the price of basic food crops. In countries and households with higher incomes the food sold and bought is less often sold in its original crop form but is usually first subject to processing and packaging. This means that the price of the crop itself does not make up the final product price as the other processes also contribute to the price. Hence if the price of food crops increase, it has a smaller impact on the final price of this processed food than it does on countries and households where the primary food crop is what is bought and not something processed. Therefore it is in lower income countries and households, where the staple diets of much of the population are made up of agricultural crops e.g. corn or maize, where the effects are felt most (Hochman et al., 2014:47). Not only are poorer households impacted negatively through relatively higher price increases but food also accounts for a much larger proportion (usually 55-75%) of household expenditures than it does for richer households. This means that upward changes in food prices have a direct impact upon their food security[17] (FAO, 2008:72-76; Banerjee & Duflo, 2007).

It should be noted however, in line with Hochman et al. (2014), that the increasing price of staple food crops was not solely caused by the expanding demand for agrofuels but was the result of a number of factors including; economic growth, exchange rate fluctuations and energy price changes

[15] The remaining 1.1% is made up of 0.9% biogas and 0.2% others (EurObserv'ER, 2014:8).
[16] Including sugarcane, palm oil, cassava and maize.
[17] Defined by the FAO as "secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active, healthy life" (2008:72).

(2014:62). However according to the FAO, the rapid increase in demand for agrofuels (whether or not it is the sole cause) will affect the food security of the poorest people at both a macro and micro level through its impact on food prices and incomes (2008:72).

Another, perhaps less cited social issue related to the increased demand for agrofuels is that of poor labour conditions for those working on energy crop plantations. This is an issue in developing countries, primarily exporting agrofuels, where labour laws are less strict and practices such as child labour are still common. The sugar cane sector in Brazil has been one of the most widely reported cases of poor labour conditions both in the literature (Franco et al., 2010; Gasparatos et al., 2012; Mendonça, 2009; Schlegel & Kaphengst, 2007; Wilkinson & Herrera, 2010) and in the media (Bilton, 2008; McDonnell, 2008; Ortiz, 2014; Phillips, 2007).

One of the most commonly cited cases is that of the working conditions found in plantations in the Brazilian state of São Paulo which accounts for more than 60% of the total of Brazil's sugarcane production (Amnesty International, 2008:760). The declining working conditions, which see the cane cutters living in squalid conditions and working extremely long hours, has resulted in serious health problems and even deaths among the workers (Franco et al., 2010:682). According to Moraes Silva (2007), workers are expected to cut from 10 to 15 tonnes of sugarcane per day which "often proves to be beyond human capacity" (as cited in Franco et al., 2010:682). As Wilkinson and Herrera (2010) explained, the problem is also related to the old method of payment (by metre harvested) which is still in use today (2010:754). Following the work of Ramos (2006) workers were expected to cut around three tonnes of cane per day in 1969, but today are expected to harvest as much as 15 tonnes per day, this means that as they are still paid based on how much they harvest, wages should have increased. However, adjusting for inflation this in fact represents a decrease in pay and also doesn't result in less hours or improved conditions (as cited in Gasparatos et al., 2012:122). Amnesty International reported on the issue in their Annual Report on Human Rights (2008) in which they said that the government were taking steps to improve the conditions for workers in the sector and that over 1,000 workers in slave like conditions had been released from a large ethanol producer following a raid (2008:76). Improvements have been seen in many cases, however in 2014 media reports were still covering slave labour in some of Brazil's sugarcane and cassava plantations (see Ortiz, 2014).

A final social implication which is far less documented however merits mention, although it will not be taken any further in this paper, namely the gender aspect of agrofuels production. The work of White, Park and Julia (2015) should be mentioned here as bringing the gender dimension of agrofuels to light. They study gender relations with regards to land access and control as well as the gendered division of labour. Their findings suggest that women usually have derived rights or access to land through male relatives and that women in some cases were discriminated against in employment practices by large agrofuel businesses due to their sex. However experiences and preferences of women differ widely between and within communities and research in this field is currently lacking.

3.2. The EU's Sustainability Criteria - an Introduction and Critical Assessment

There are a number of different methods through which the consumption and production of agrofuels are monitored and regulated, ranging from the local to the international level and from voluntary to mandatory schemes. Examples of such regulation include certification schemes, industry standards and documents providing guidance and advice (Allen, 2016:12), however as this paper looks to assess regulation at the EU level, the focus will be on sustainability criteria which is the method through which the EU legislate the production of agrofuels in the RED (Directive 2009/28/EC). The role of the criteria is to make sure that the increased production of agrofuels driven by policies is carried out in a sustainable way and does not cause negative impacts. The criteria are in place to help safeguard the achievement of the policy targets and to control and minimise unintended consequences which are common when a resource is suddenly incentivised (Allen, 2016:12).

Although the EU do not provide a specific definition of sustainability criteria in the RED, the concept has been explored from different perspectives in the literature (Goldschmidt et al., 2013; Koplin et al., 2007; Markevičius et al., 2010; Simpson & Power, 2005; Wallbaum et al., 2010; Zink, 2005). However, there tends to be a lack of homogenous definitions and different fields prioritise different aspects of sustainability criteria.

The most relevant for this paper, which is assessing sustainability criteria within a legal framework of agrofuel production, is perhaps that given by Pavlovskaia (2014) who takes both a legal and environmental approach to defining sustainability criteria. Pavlovskaia defines a single criteria for sustainability succinctly as “requirements to the sustainable quality of a product and its sustainable production, which have to be fulfilled in order to acquire a sustainable status” (2013:76). In terms of the effectiveness of sustainability criteria, it should be noted as Pavlovskaia (2014) does that they cannot function alone to guarantee that production is sustainable, they must be complemented by other tools and instruments. One of the advantages of using sustainability criteria is that their existence provides some long-term perspective and certainty which incentivises investment by businesses (2014:1-2), which is a clear priority for the EU in the case of agrofuels to increase business sector investment in the resource. However, effective sustainability criteria should also be flexible and consistently adjusted to take account of new technologies and approaches as well as unexpected outcomes and issues that represent challenges to their sustainability (Allen, 2016). This is however of course only in theory, whether it is the case in reality will be explored subsequently.

The sustainability criteria for agrofuels which must be met for them to count towards the 20% renewable energy target are set out under Article 17 of the RED (for transport specificities also FQD 2009/30/EC, Art. 7b). Figure two summarises the main components of the criteria.

Figure 2 *- Key Areas of Sustainability Criteria as Set Out in Article 17 of the RED*

GHG Emission Savings[18] **[Art.17(2) RED, Art.7a FQD]**:
GHG emissions savings from biofuels that count towards renewable transport fuel targets should be 35% compared to fossil fuels.

Biodiversity [Art.17(3)]: biofuels shall not be produced from raw materials from land with high biodiversity value, that had one of the following statuses in or after January 2008, whether or not it continues to have that status:
- *Primary forest* and wooded land where there is no clear human activity
- *Areas protected by law* for nature preservation or international agreements
- *Highly biodiverse grassland*

High Carbon Stock [Art.17(4)]: biofuels shall not be produced from raw materials from land with high carbon stock value in January 2008 and no longer has that status:
- *Wetlands*
- *Continuously forested areas*
- *Land spanning more than one hectare dominated by trees*

Peatland [Art.17(5)]: biofuels shall not be produced from raw materials from land that was peatland in January 2008, unless there is evidence that cultivation of raw materials on such land does not involve drainage of previously undrained soil.

Source: Directive 2009/28/EC

Many scholars studying and assessing EU regulation of biofuels have come to critique the sustainability criteria method for a number of reasons (Frank et al., 2013; Hennecke et al., 2013; Markevičius et al., 2010; Silva Lora et al., 2011; Soimakallio & Koponen, 2011; van Dam, Junginger & Faaij, 2010; van Dam & Junginger, 2011). The critiques are related to the negative impacts arising from increased consumption of agrofuels which are clearly not being prevented by the criteria. In general they cover; the lack of any social criteria, the overuse of certain feedstocks not covered, the missing coverage of ILUC and the oversimplification of the calculation method for GHG emission savings.

As one of the most central aspects of the argument for agrofuel policy and therefore one of the main tasks of the sustainability criteria is to ensure that the consumption of agrofuels does not worsen climate change and contributes to the mitigation of this process. As the use of land with high biodiversity levels is also prohibited in the criteria, it should be the case that these two measures are being achieved. However as has been shown in the previous section, this is not the case. One study conducted by Frank et al. (2013) which aimed to analyse the effectiveness of the sustainability criteria with regards to climate change mitigation and biodiversity conservation found that under member states NREAPs, agrofuel expansion required 2.2 million hectares (Mha) of highly biodiverse areas (+12.4% additional biodiversity loss), 1 Mha grassland conversion (+45.8%) and an increase in total deforestation of 2.4 Mha (+4.2%) and would generate 95 Mt CO_2 equivalent of additional GHG emissions (2013:310). However, importantly they show that EU agrofuel demand can be satisfied 'sustainably' so to say according to the RED even though negative environmental

[18] It should be noted that the required GHG emissions savings were changed in 2015 through Directive 2015/1513 which made some amendments to the RED. The new requirements for GHG emissions savings for existing installations were given a transitional period during which to achieve the savings of at least 35% by 31 December 2017 and at least 50% from 1 January 2018. However, stricter requirements were implemented for new installations (operating after 5 October 2015) that are required to reach reductions of at least 60% (Directive (EU) 2015/1513).

impacts occur. The reason for this is that most of the crops produced globally are 'sustainable' according to the RED and, if they are reallocated from other sectors without sustainability criteria, make up more than enough to supply EU demand in 2020 (Frank et al., 2013).

The debate over which calculation methods are allowed to measure GHG savings is one of the central critiques focused upon in the literature. Under the sustainability criteria, a number of different calculation tools can be used, this allows producers to select which method they prefer. One study carried out by Hennecke et al. (2013) compared the results from using two different methods to see whether it makes a difference which is selected. They follow the methodology of the RED and used exactly the same input data for both tools, however their results are very different. For example they find that the GHG emissions of the ethanol pathway from wheat were 21% lower using one method than using the other. For biodiesel from palm oil, the deviation was 20% and for ethanol from wheat and sugarcane, 35%. These results show that it is possible for a producer to 'enhance' the sustainability of their agrofuel with regards to GHG emissions by using a different tool for calculations without making any sustainable changes to the production. As this is not specified in the RED, producers are free to choose which calculation tool they use, this is clearly problematic as essentially producers are able to "significantly underestimate their actual impact" (Soimakallio & Koponen, 2011:3504). The methodology in the RED is not able to ensure the intended GHG emission reductions of agrofuels even if it is followed and the GHG targets are met.

The carbon counting method can be seen as a way of "commoditising natural resources in the name of protecting them" (Levidow, 2012:220). The EU method has been criticised as "neoliberalising the environment" (Brunnengräber, 2015; Levidow, 2012:221; Vogelpohl, 2015) in order to ensure that there is a market for agrofuels. Within the market, in order to internalize any environmental effects (which are usually complex) they must be simplified and made quantifiable (Lohmann, 2011:112), this is what the sustainability criteria ensures. The fact is that nature cannot usually be categorised so easily, for example, when dividing land into either high or low carbon stock there is a huge gap in the middle which should not be left out. Using carbon counting as a tool to quantify the environmental impacts of agrofuels can be carried out fairly easily. However being able to quantify the impacts accurately is in fact something very difficult to achieve and this difficulty is overlooked by using the simplified carbon counting tool. In this sense the sustainability criteria can be criticised on the grounds of "homogenizing" (Levidow, 2012:221) the environment and therefore not taking into account any local differences or social effects of the policy. This has worked to the EU's advantage, shifting the focus of any critique of the criteria onto the different methods of carbon calculations and distracting from those against agrofuels by producing a very technical debate. This manages to reduce the focus on the other negative impacts discussed previously (Levidow, 2012).

In general 'sustainable' implies not only environmental sustainability but also social sustainability, although the EU do not provide a clear definition of sustainability in the sustainability criteria, in the communication on the guiding principles for sustainable development they state that it "seeks to promote […] social and territorial cohesions and environmental protection" (EC, 2005:3). Hence, the absence of such social criteria was another contentious issue[19]. In a document published in 2009

[19] Social criteria was relegated to voluntary schemes or bilateral agreements by the EU and must be reported on every two years by the Commission to the Parliament and the Council, such reports would cover the impact of increased

by EuropeAid that aims to "establish criteria for agrofuels project to be supported by the ACP[20]-EU energy facility" and "contribute to increase access to energy services in rural and peri-urban areas in the country where the agrofuels are produced" (2009:1), the EU Commission stated with regards to the RED that

> "these directives do not include mandatory social criteria (labour conditions, land tenure, etc.), nor food security criteria, because of the difficulty to verify the link between individual biofuel consignments and the respect of these particular criteria"
>
> (EuropeAid, 2009:2)

In spite of this being printed in 2009 no additional social security has been added to date, even though since then clear violations of the social rights of people involved in production in third countries have been witnessed and evidence has been found linking agrofuel production to decreasing food security. In essence, the implicit definition followed by the EU in the sustainability criteria is far narrower than the definitions of sustainable development they provide and follows a much more technical approach, which effectively reduces the concept of sustainability to the singular goal of GHG emission savings.

4. Deeper Policy Analysis

It seems to be clear that in spite of having regulation in place to monitor the production of agrofuels and *ensure* they are produced in a sustainable manner that fulfils the criteria set out, serious social and environmental problems continue to arise as a result of increasing demand in the EU, fuelling increasing production in developing countries. An important question therefore is why and how this continues to happen. In order to answer this, it is necessary to make a deeper critical policy analysis of the EU's agrofuel policy and sustainability criteria.

One reason for why such issues related to the EU agrofuel policy have arisen under the RED policy is the way in which the policy was created. Policies in theory should be the result of an assessment of all the evidence which is first gathered and reviewed. In order to reduce the possible risks or negative outcomes, possibilities need to be assessed and ways of countering these determined (Sharman & Holmes, 2010). Of course, it is not possible to foresee every outcome a policy may have, but when it is clear that negative outcomes are arising then changes need to be made. Successful policies or sustainability criteria are those that are constantly monitored and modified in order to keep on top of and minimise negative outcomes (Pavlovskaia, 2014:6).

An important principle that should guide EU policy making is the precautionary principle, which is detailed in Article 191 of the Treaty of the Functioning of the European Union. The aim of the principle is to use preventative decision-making in the case of risks in order to ensure a higher level of environmental protection (EC, 2000). The principle should be followed when there are "reasonable grounds for concern that […] the environment, humans, animal or plant health may be inconsistent with the high level of protection chosen for the Community" (2000:2). This principle is clearly relevant in the policy setting of renewable energy to ensure the protection of all four

production on social sustainability, availability of foodstuffs and wider development issues (Directive 2009/28/EC, Art. 7).

[20] The African, Caribbean and Pacific (ACP) Group of States is composed of 79 states from across Africa, the Caribbean and the Pacific, all of them (except Cuba) are signatories of the Cotonou Agreement which is also known as the ACP-EU Partnership Agreement (ACP, 2011).

categories. According to Levidow (2001) the principle provides regulators with a method "to acknowledge the limits of science as a basis for policy, while seeking to clarify uncertainties" (2001:845). However, it is clear from having assessed the outcomes of the RED that the precautionary principle was not given very high priority during the policy making process.

This claim can be supported by evidence from a study carried out by Sharman and Holmes (2010) who conducted a "qualitative investigation into the development process of the 10% target in the RED" (2010:4). Their findings were that the production of agrofuels in the EU *could* be made amenable to two of the policy motivations[21], however for the third[22] this was highly questionable given the evidence considered. From the interviews carried out by Sharman and Holmes of members of the RED policy network[23] they found that evidence supplied by the DG Agriculture and Transport and Energy (who supported the 10% target) was given a higher priority and had more of an influence on the final decision than evidence which was critical of the environmental impacts, which came from DG Environment, the European Environment Agency (EEA) and environmental NGOs. One interviewee suggested that evidence from these reports was moulded to suit the decision that a mandatory target was necessary, parts of the evidence were taken out of context and anything that was mildly positive even if not related directly to agrofuels was quoted and given disproportionate importance (2010:7-9). This makes clear how even if scientific evidence provided is not in support of a planned policy, policy-makers are able to misuse it to support their desired outcomes.

Also noted by the interviewees was the power that individuals had if they were able to display 'expert knowledge' on the topic, an ability which not everyone in the decision process had. The capacity of the individual who was the policy entrepreneur for agrofuels to utilise very technically challenging data and evidence in comparison to others who were not familiar with the specific science gave him a much greater influence over the other actors and more power when making the final decisions. As they become recognised as an 'expert' their opinions or knowledge becomes worth more than other 'non-experts' (Sharman & Holmes, 2010:8-9). In the case of agrofuel policy it seems clear that the scientific evidence was utilised as a tool to manipulate the other decision-makers by those pressing for the policy and 10% target. This was how, in spite of fairly widespread scientific evidence questioning the environmental and social sustainability of agrofuels, the policy was passed.

It can be concluded that the agrofuels policy in the form of the RED is an example of "policy-based evidence gathering" as opposed to the correct method of "evidence-based policy" (Sharman & Holmes, 2010). The RED policy was clearly determined prior to the evidence collection, so the evidence subsequently collected was that which supported the policy and if it didn't it was either used in a way which made it look like it did or it was given low priority by so called 'experts'. If the RED policy had instead been based on the evidence or took into account impacts that came to light in the early years of its implementation, it would certainly not look like it does today.

[21] Rural development and energy security.

[22] GHG emission reduction and environmental sustainability in general.

[23] The interviewees came from the RED policy network which included policy officials who were directly involved in the RED formulation, NGO and agrofuel industry representatives and academics in related fields (Sharman & Holmes, 2010:4).

This helps to answer effectively the question of how the RED policy and its sustainability criteria are ineffective with regards to sustainability, the criteria have been designed to selectively account for potential harm. As argued by Levidow (2012), the controversy surrounding the agrofuel debate was translated into the sustainability criteria which he explains selectively accounted for carbon in order to justify and reinforce the need for EU mandatory targets for GHG emissions (2012:216).

Another area of contention in the sustainability criteria, which shows how it is possible that criteria are in place to ensure the sustainable production of agrofuels while at the same time negative environmental and social impacts are arising, is the contention over some of the definitions used. This point is mentioned by a number of scholars (Farigone, 2008; Franco et al., 2010; Levidow, 2012; Magdoff, 2008; White & Dasgupta, 2010) in relation to the use of the term ‘marginal’ or ‘degraded’ land in the sustainability criteria. The issue here is that the EU suggest growing agrofuels on this so called ‘marginal land’ so as to avoid ILUC from occurring and increasing rural development, however they fail to acknowledge that what they refer to as ‘marginal land’ may be of crucial use to rural populations who sometimes live off such land.

One high-profile example picked up by a number of scholars (Hunsberger, 2015; Levidow, 2012; Ribeiro & Matavel, 2009) is related to the agrofuel feedstock crop jatropha, which was touted at one point as a miracle crop that can be grown in very dry lands. However, as Ribeiro and Matavel (2009) found, in Mozambique where large amounts of ‘marginal land’ have been used to grow jatropha, no cases from the literature, communities, industry experts or individuals who were interviewed for the research could provide positive examples of high yields being produced on marginal land. The crop actually needed large volumes of water and chemicals in order to make production commercially viable, clearly having negative environmental impacts and not fulfilling the EU’s sustainability criteria (2009:39). Franco et al. (2010) also found that the livelihoods of those living in rural areas where large sections of land have been designated for agrofuel production have in fact seen no improvements as a result, few jobs have been created and many resources have been diverted from food production to the production of agrofuels (2010:684). As Levidow (2012) argued in light of examples like this, EU agrofuel policy in fact “pre-supposed a socially beneficent agro-industrial development using mainly ‘marginal lands’” (2012:218).

The issue stems from a theoretical basis and may have been foreseen by policymakers. By using a negative and vague concept such as ‘marginal’ it is a clear example of this narrative tool utilised in policy making, where it is used to depict a positive and not harmful role of agrofuel production in developing countries. It leads people to believe that agrofuels are being produced on infertile or unused land which is now fertile and even creating jobs for local farmers. Such rhetoric works effectively and can be successfully operationalised by using regulatory measures which then protect the ‘best’ or most fertile and precious lands such as ‘high carbon stock’ or ‘areas of high biodiversity’. The concept of ‘marginal land’ is a normative measure which has been used to classify lands in developing countries with no strict definition in order to make it seem positive that the EU are in effect colonising land once again in developing countries (Borras & Franco, 2009).

Issues have also been raised with the narrow definition of land in general. Franco et al. (2010) suggest that the EU use a purely economic definition of land in their agrofuels policy on purpose in order to simplify what is in fact a very complex term. Land has not only economic aspects in terms of its use value and whether it is available for agrofuel crops or not, but also equally important social, political and even cultural features which are ignored in the EU policy. By using a narrow definition, it transforms what is a very complex natural resource with difficult attributes to manage and define into something much more simple and easily dealt with in policy. The wider implications of land and the impacts it can have on populations, both socially and culturally, which are especially important in rural areas, are completely excluded (2010:674-675).

5. Case Studies

The empirical section of this paper utilises secondary data analysis to analyse two country case studies, Germany and Indonesia. Through the selection of these two case studies, this paper aims to show three things. Firstly, these examples will show frictions with the central justifications used to promote agrofuels by the EU in practice i.e. energy security, environmental protection and rural development in reality are not experienced. Secondly, support to the more general findings of the environmental and social impacts will be given with concrete cases. Thirdly, the influence and dominance of the main actors involved will be made explicit, whilst showing the far reaching nature of the EU's policies and displaying that it is the same type of actors in each country that are dominant, namely the state, MNCs and the business sector.

5.1. Germany

Germany is seen as a front runner in the EU with regards to renewable energies and especially agrofuels as they are the leading producer and consumer of biodiesel in the EU (Bomb, 2007:2259), making it an interesting case to analyse. Agrofuels have a history longer than thirty five years in Germany (Franco et al. 2010:676), the government have been heavily involved in backing the agrofuels industry since the early 1990s (Bomb, 2007:2258). The most recent promotions coincided with the increasing interest in agrofuels at the European level in the early 2000s, around this time the German government introduced tax incentives to promote the production of agrofuels. In 2006 blending quotas were introduced when Chancellor Merkel announced that Germany should strive to go further than the EU targets. Germany's national regulation monitoring the production of agrofuels (Biomass Sustainability Ordinance) follows closely the EU RED in terms of sustainability criteria and also does not include ILUC (Franco et al., 2010:676-677).

Energy Security

One of the central components of the EU's agrofuels mandate is the assumption of the positive impact it can have on energy security. This aspect was also a core argument in Germany due to the high levels of domestic production in the country, and was seen (in theory) as a clear way of reducing reliance on imports and increasing self-sufficiency. However, it seems to be the case that in reality agrofuel production in Germany has contributed very little to energy security (the two key reasons as to why are explained below) and has in fact reduced the diversification of supply as the increasing usage of agrofuels has resulted in more overall fuel use in general (Franco et al., 2010:678-679).

As a result of blending quotas and the use of normal cars, which can only run on low blends of agrofuels, in effect the transport sector remains predominantly reliant on fossil fuels and the introduction of agrofuels to the sector has in fact created growth in the transport sector by complementing the consumption of fossil fuels (Franco et al., 2010:689). This means that the amount of fossil fuels imported has been unaffected and essentially the introduction of agrofuels has resulted in little impact on energy security.

In 2007, agrofuels made up 7.3% of transport fuel in Germany, however in order to produce this amount of agrofuels, already 10% of Germany's agricultural land was being used to produce agrofuel feedstocks and 70% of the domestic rapeseed produced was being used for the production of biodiesel. In spite of this Germany was still reliant on importing oilseeds from Eastern Europe and elsewhere to meet increasing demand. Therefore further expansion of the agrofuels sector would result in the need for further imports, negatively impacting Germany's energy security (Franco et al., 2010:689).

Environment

The availability of enough land to grow crops on to satisfy agrofuel demand in Germany is an issue. The only way to increase production of rapeseed oil domestically would involve the use of permanent grasslands to grow feedstocks, however already the maximum amount allowed to be used under the Common Agricultural Policy (5%) has been reached. Hence imports are necessary and in fact cheaper than domestic produce, in fact of the 7.3% consumed in 2007 less than half were from domestically grown energy crops (Franco et al., 2010:679). According to a study carried out by Bringezu et al. (2009b) into the implications on global land availability as a result of Germany's agrofuel consumption, Germany was in fact a net importer of arable land in 2004 already, using almost 20.6 Mha globally for their consumption of agricultural goods (2009b:57-62). Bringezu et al. calculate that by 2030 domestic land will only be able to produce enough energy crops to meet one fifth of the demand, meaning imports will be necessary. They estimate that the consumption of biodiesel alone in 2030 in Germany will cause an increase of 37-54 Mt of GHG emissions as a result of land-use changes in tropical countries which export agrofuel feedstocks. They calculate that the use of biodiesel under these conditions would reduce the overall GHG savings by 52-77% in 2030 (2009b:63-64). These emissions that are a result of ILUC in other countries are not counted officially, which is how the EU continues its attempt to promote agrofuels under the guise of emission saving (Franco et al., 2010:689).

Dominant Actors

The German government has been at the centre of agrofuel promotion in the country and has pushed the growth of the sector successfully with the use of tax exemptions and quotas. Under government policies, Germany's production of agrofuels (mainly biodiesel) increased by a factor of five from 1 to 5 Mt in only four years[24] (Franco et al., 2010:677). However, the government was not alone, but worked in close partnership with both the oil industry and the automobile manufacturing sector who are very powerful in Germany. Together, these three actors developed the transport fuels strategy and excise duty exemption which make up the regulatory framework that promotes the agrofuels industry (Bomb, 2007:2259).

The agrofuels industry itself is made up of many producers and suppliers who are organised through a number of extensive trade associations that have strong power when it comes to lobbying policy-makers. These trade associations also facilitate the cooperation between the agrofuels industry, the oil sector and car manufacturers. The leading trade association in this field is the Union for the

[24] 2004-2008.

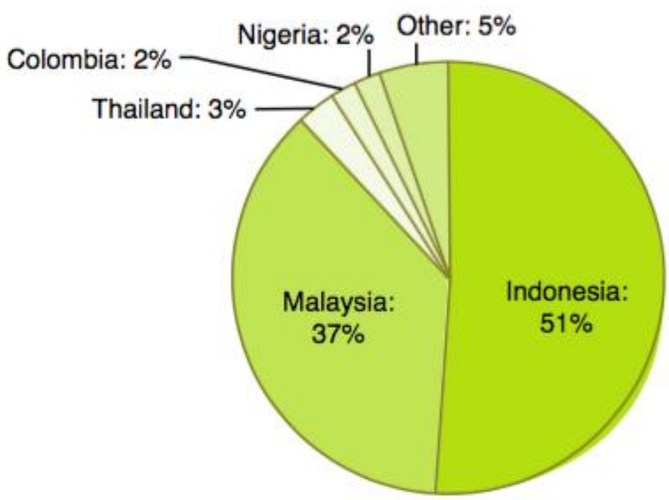
Promotion of Oil and Protein Crops, who along with other associations have been able to influence the EU agrofuel mandate through the German national government who has played a decisive role in the promotion of agrofuels during the development of the EU policies in the field (Bomb, 2007:2261). Such close ties and cooperation exemplify in reality how much influence dominant actors can have towards policy making and show how closely governments work with other sectors, even if their views should be questionable due to their position to gain from the policies they promote.

However it should be noted that improvements are being made in Germany to address the GHG emission concerns. New legislation which came into effect in January 2015 now means that a target for the climate performance of biodiesel is prioritised over the target for a minimum amount of agrofuels in transport (Beckman, 2014). This represents steps in the right direction, however is currently not reflected by any changes at the EU level.

5.2. Indonesia

Indonesia produces and exports the largest amount of palm oil (the cheapest and most popular feedstock for biodiesel production) in the world. Production has been subject to recent rapid expansion in line with the increasing number of agrofuel mandates on the international energy market (Pichler, 2010, 2011). In 2008, Indonesia was producing 18 Mt, of which almost 78% was exported, production can therefore be said to be based on an export-oriented model. By 2011, Indonesia was producing over half of the world's crude palm oil (Figure three). It is noteworthy that production doubled during the period from 2001 to 2007, which coincides with the start of the global agrofuels boom (Pichler, 2010:178-179). Indonesia also has agrofuel regulations in place with blending quotas of 1% since 2009 that will be increased to 25% by 2025. Currently palm oil is the only cost effective and abundant feedstock available which means that any plans to variegate resources seem unlikely in the near future (Pichler, 2010:180).

Figure 3 - *Crude Palm Oil Production by Country (2011)*



Source: Varkkey, 2012

The case of palm oil production in Indonesia provides an empirical example of the drastic effects of the global agrofuels boom on the environment and people of countries which have specialised in the production of feedstocks as a means through which to increase economic development and, under assumptions of the EU, promote rural development. Indonesia exemplifies the political implications on human-nature relations in the country and the social and ecological impacts that result.

It is important when looking at the case of Indonesia to briefly mention the Roundtable on Sustainable Palm Oil (RSPO) which is a

> "multi-stakeholder initiative that is composed of palm oil producers, state officials, trading companies, banks, NGOS etc. which have developed principles and criteria for sustainable palm oil production"
>
> (Pichler, 2011:15)

The initiative, created in 2002 by Unilever (European company) and WWF (environmental NGO), is voluntary and members can choose whether to comply with the sustainability criteria or not which act mainly as guidelines. According to Pichler (2010) the criteria aim to create a win-win for all of the different stakeholders listed above under the motto "People, Planet, and Profit" (2010:189). The RSPO does nothing to challenge the real problems associated with the large-scale production of palm oil and has received criticism from environmental and local NGOs in Indonesia as being ineffective (Pichler, 2011:15). It is seen primarily as a way of marketing South East Asian palm oil to environmentally conscious buyers in Europe and as a way for companies and supermarkets in Europe to look as though they are part of a sustainable initiative when in reality it is little more than another meaningless label.

Rural Development

The palm oil market in Indonesia has an oligopolistic structure dominated by a small number of large scale conglomerates[25]. Many of these large dominant companies create sub-companies in order to get around the law which limits the amount of land allowed per company. These companies have a number of strategies they use in order to take control of rural land which may be farmed by local farmers, small-scale holders or just lived on by local communities and farmed by them to live. One strategy used is to persuade the leader of the community that the benefits for them and the rest of the village will be great, often they also give donations to this person in an attempt to convince them. If this method fails then the company may turn to intimidating the local people or evicting them by force. In these cases the military is often brought in to carry out forced evictions (Pichler, 2010:182).

Violence is often associated with the conflict over land between local communities and large companies. According to research on the ground by Pichler (2010), Friends of the Earth Indonesia[26] confirmed that violence is one of the central problems they are trying to tackle and is common both during the displacement of local people in land conflicts and on the plantations themselves where workers can be subject to violence if their performance is deemed inadequate (2010:188). Another problem arises when local populations speak out against the palm oil industry. According to communication with a spokesperson from a farmers union in Indonesia (see Pichler, 2010), the government often criminalise such groups and communities in response and accuse them of being against the development of the country (2010:181).

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[25] The majority of which were previously involved in logging or paper plantations which makes it easy to switch to the production of palm oil (Pye, 2009:87).

[26] A grassroots environmental organisation.

One of the central issues is the deficient information that is provided to local communities and farmers by palm oil companies about the real impacts of the agreements they are asked to enter into. Companies paint the picture of better lives for these communities with higher incomes and the promise of many jobs but the reality is that these expectations are not met and locals often end up facing conditions of exploitation both in terms of labour and pay, are often in debt and have lost all control of their land (Pye, 2009:92). This lack of transparency is evident as it is reported that communities which in one way or another have been previously involved with the large-scale production of palm oil are far more likely to be against expansion plans, whereas communities which have had no experience with the industry often agree with the terms and conditions given to them by companies for selling their land and becoming employees (Pichler, 2010:187).

A lack of knowledge on the realities of the palm oil plantations, combined with a lack of formal land rights for indigenous communities and small-scale farmers result in them having little power against the government and large companies and means it is extremely common place for them to be evicted from their home lands to make space for plantations (Pichler, 2010, 2011). This evidence together does nothing to confirm the assumption of increased rural development in the EU's agrofuel policy. In fact, in spite of jobs being created, the low wages workers receive do not contribute to the elimination or even reduction of rural poverty but in reality end up trapping communities into a life of poverty (Pye, 2009:92). What becomes clear is that the government and palm oil industry sell a different understanding of development, offering higher incomes through intense monoculture production in exchange for peoples previous subsistence based livelihoods, effectively using a "development strategy that was introduced by colonialists" (2009:93). If anything it makes clear the dominance these companies wield and the uneven distribution of power between palm oil companies and the Indonesian government on the one hand and local and indigenous people on the other, who become increasingly marginalised as a result.

Environment

Environmental concerns related to the expansion of the palm oil industry in Indonesia are extremely prominent. According to the Worldwatch Institute, in 2009 Indonesia ranked third in the world for GHG emissions[27] behind China and the USA (Block, 2013). The most recent figures for 2014 from the Global Carbon Atlas rank Indonesia at number seven in the world which is still significant for a country of its size. When measuring emissions from land use change, South-East Asia ranked second[28] emitting 1,164 Mt of CO_2 (Global Carbon Atlas, 2015).

The expansion of production in Indonesia during 2000-2009 came at the expense of 340,000 hectares of rural land which was mostly tropical lowland forests. In 2010 it was estimated that around 7 Mha of land was being used by plantations. Evaluations of how much expansion has encroached into peatlands vary but estimates suggest that for each hectare that is drained for agricultural use, approximately 3,750 to 5,400 tonnes of CO_2 are released over the following quarter century. To contrast, when tropical forest is cleared between 500 and 900 tonnes of CO_2 is emitted (Block, 2013). Over the past decade, the Indonesian government has approved palm oil concessions on over 6 Mha of peatlands (Cochrane, 2016).

[27] Due primarily to the expansion of palm oil production.
[28] Behind tropical South America, primarily Brazil where large amounts of land are used for growing sugarcane to produce ethanol.

Every year areas of forest are burned in the country as a cheap way to clear land with devastating impacts on the environment and the animals and people living in such areas. This results in a ‘toxic haze’ which often sits over large areas of South-East Asia following these fires; the haze after the fires of 2015 which destroyed an area more than 10,000 square miles lasted for weeks, made thousands of people sick and killed a number of endangered orangutans which are native to the forests in Borneo and Sumatra (Cochrane, 2016). One study calculated that the forest fires of 2015 released the largest amount of CO_2 since 1997 and produced emissions greater than were released by the whole of the EU (Lih Yi, 2016).

Although it is technically against the law to clear land for plantations by burning, the government are extremely lax at enforcing it and no large corporations have ever been taken to court over the issue which ends up sadly being a common practice (Cochrane, 2016). Warnings of even worse fires and haze have been given by environmentalists as a number of major palm oil companies recently abandoned a new zero deforestation pact. The pact, which was signed in 2014, was seen as a landmark agreement by the major firms invested in the country to limit which land could be cleared for plantations. However, the agreement has now been ditched in favour of the governments less strict standards (Lih Yi, 2016).

Dominant Actors

The Indonesian government plays a vital role in the expansion and promotion of the palm oil industry in the country. The role of the state in facilitating such large-scale expansion and domination of humans over nature is central; in order for the industry to continue its business and to grow, in spite of the criticisms, it has to be both “politically supported and institutionally protected” (Pichler, 2011:10), which is carried out by the state who ensure support, protection and development of the industry through regulations, laws and policies. According to Pichler (2015), the legal strategy of the state allows it to “succeed in universalizing dominant interests whilst at the same time (partially) integrating subaltern interests” (2015:508).

The Indonesian palm oil industry is made up of a few large companies who control the majority of the industry and have a close relationship with the government, military and investors. The mutually beneficial existence of both economic and political power that exists within the industry is responsible for the way in which the expansion is occurring at the expense of rural populations. The combination of state and business interests results in the relegation of social and environmental interests in favour of a development strategy for the country linked predominantly to the exportation of palm oil and hence upon the expansion of the industry (Pye, 2009:89).

NGOs are also important actors in Indonesia as they try to educate and raise awareness throughout the population of the detrimental environmental and social impacts of the palm oil industry. They aim to bring these issues onto the political agenda but as in most scenarios the extent of their activities is limited by the relationship they need to maintain with the government and companies if any agreements are to be reached. This increases the risk of them being used by the industry to legitimise the business as the example of the RSPO makes clear. A number of NGOs backed the RSPO, in which the WWF played a central role. However in light of the limited impact the RSPO made on addressing the social and ecological consequences of palm oil expansion, this has led to criticism of the WWF on the grounds that it authenticates the RSPO and gives it false credibility (Pichler, 2010:188). It is for this reason, that often the smaller grassroots organisations have more success on the local level as they do not have such a high level of involvement with the government.

As described accurately by Pye (2009), the palm oil boom in Indonesia "represents a multiple crisis, linking the crisis of climate change to that of biodiversity loss, of development, and ultimately, of legitimacy" (2009:96). The EU, through their agrofuel agenda, has helped to develop and are now worsening this multiple crisis. As this case has shown, the sustainability criteria of the EU does very little to prevent the ecological and social impacts occurring in developing countries which export agrofuel feedstocks. The criteria have no effect on the ongoing, environmental degradation, biodiversity loss, land conflicts, land-use change and human rights violations in Indonesia (Pichler, 2010, 2011, 2015).

5.3. Conclusions & Comparisons

As the example of Germany has shown, two of the key assumptions upon which the EU's agrofuel policy rests, namely promoting energy security and GHG emission savings, have been proven to be optimistic if not far from the reality. In order to meet targets, the growth of feedstocks has not only expanded domestically and in some cases onto important grasslands, but their reliance on imports has also increased; by 2006 the amount of biomass imported to Germany was already 60% (Franco et al., 2010:679), not the kind of figures associated with a country that is energy self-sufficient. This has resulted in increased GHG emissions in third countries[29] which export to Germany, where increasing amounts of land are being cleared to grow energy crops at the expense of the environment (Franco et al., 2010:679).

As the case of Indonesia has made clear, the environmental impacts of the rapidly expanding palm oil industry are devastating for both the land and the people and animals that live on it. The EU assumption of reduced GHG emissions as a result of their agrofuel policy therefore may apply to a certain extent within the EU, however, it is clear that if the direct and indirect land-use change emissions from third countries which export to the EU are considered then this is not the case.

With regards to the promise of rural development and the chance for economic gains in developing countries, this case study has shown that although the industry may have allowed the country to develop economically, it has come at the expense of its people and environment. The economic gains are focused in the hands of those who promote the industry, namely the state and the large companies involved. Such outcomes have increased social tensions in the country as traditional ways of life such as subsistence or small-scale farming which are now unsupported are becoming more difficult to carry out under continuing pressure on the land and the people to meet the increasing needs of the industry. These strains are evident in the large number of ongoing land conflicts between rural communities and the palm oil industry. This situation depicts the important role of power, who has power and control over the land and who is it that benefits from this at the expense of the increased marginalisation and weakening position of local communities and in effect the strengthening of existing inequalities (Pichler, 2010, 2011).

Linkages become apparent from analysing the situation in Germany and Indonesia, the promotion of agrofuels results in key actors and drivers that converge and interact across the cases and with the EU. The EU agrofuels mandate has been pushed through as a result of the strong political coalition

[29] Made explicit in the case study of Indonesia.

between the government and this growing group of agrofuel energy corporations made up of the interested parties and those involved in the production. Such alliances and relationships are seen at every level, on both the EU and at the member state level. With strong partnerships between the state, oil companies and the car manufacturing industry and now also in developing countries where similar coalitions between the state and the powerful companies that dominate feedstock production can be found, as in the case of Indonesia.

6. Conclusion

The main aim of this paper was to analyse the current EU policy on renewable energy and more specifically on agrofuels as this area is becoming increasingly contentious due to its rapid expansion and as a result is in need of serious reassessments as this paper has shown. A comprehensive evaluation of the EU's agrofuel policy has been conducted; firstly, with a specific focus on investigating what the social and ecological impacts of the policy are, both in the EU and in agrofuel exporting countries and, secondly, on an evaluation of the main method used to ensure sustainability.

The evidence provided throughout the paper revealed extensive flaws within the main assumptions of EU agrofuel policy, namely that it would promote rural development, energy security and GHG emissions savings. Through an assessment of the impacts of increasing demand for agrofuels in the EU, it was shown that contrary to the narrative of pro-agrofuel policy, increased production of feedstocks is in most scenarios increasing biodiversity loss, deforestation and land-use change in the countries of production and in most cases the assumptions of significant GHG savings were optimistic if not proven false. At this time there is no evidence upon which to presume that the current consumption of agrofuels in the EU up until 2020 will deliver GHG emission savings, however, there is more evidence to suggest that there is significant risk, if not certainty, of additional emissions being released instead, if not within the EU then in feedstock producing countries.

As an assessment of the social impacts of increased demand for agrofuels showed, the assumption of rural development also seemed optimistic to say the least. With evidence of the increasing competition between crops for food and fuel and the poor labour conditions for those working in the industry still prevalent, these issues are left unaddressed by the policy. Essentially this paper has shown that agrofuels are "systematically connected with negative effects on food production and security, natural resources, including land, soil and water and rural development" (Brunnengräber, 2015:74).

It seems clear that the driving forces behind both the EU policy and national level agrofuel agendas is this coalition of actors involving the government and the most powerful sectors who are set to gain from the growth of agrofuels. At the EU level the influence of the oil, auto and forestry sectors in the formulation of the policy was notable. The same is true on the national level as the case studies have shown, in Indonesia the government and the large palm oil companies create a successful business climate and also in Germany the government works closely with the strong auto manufacturing and oil sectors. What do these partnerships mean for the appropriateness of the policies and their implementation, effectively the biggest impact is the prioritisation of a successful business climate and profits over anything else. The policy has been designed to encourage investment in the long term partly through the use of targets and this has come at the expense of the environment and rural populations in developing countries. In short it can be described as a "corporate-led" (Franco et al., 2010:692) agrofuels project.

The dominance of power these coalitions have in the policy making process has influenced how appropriate and effective the design of the sustainability criteria was in monitoring and regulating the sustainable production of agrofuels, both in the EU and in countries who export to the EU. It has been shown that the criteria were completely ineffective with regards to any social issues which are continuously a problem for local populations and those working in the agrofuels industry in developing countries. The criteria have also been shown to do nothing to control a number of environmental issues arising in countries producing agrofuel feedstock. The criteria have a number of serious shortcomings in its design, which have been discussed in the paper, that prevent it from effectively ensuring that agrofuel feedstocks are produced in a sustainable manner. In summary, systemic issues with the formulation of the policy itself and the clear negligence of the precautionary principle during the conception of the RED as well as the "policy-based evidence gathering" instead of "evidence based policy" (Sharman & Holmes, 2010) meant effectively that from the start the policy was likely to be ineffective in terms of ensuring high levels of sustainability, but suitable for the priorities of the policy makers which were focused on promoting the conventional agrofuels industry and maintaining its constant growth and development.

The use of deceptive language is also problematic with words such as 'sustainable', 'bio' and 'protection' being used to create the perception of a policy that was good for the planet whilst concealing the real impacts. The main issue with placing bioenergy at the centre of any renewable energy strategy is that it is different from other renewable energy resources in one very important aspect; bioenergy (like fossil fuels) is reliant on raw materials which means that it is only renewable within certain limits. This means that the use of agrofuels is extremely sensitive to supply, it is far more likely to be renewable on a small and local level and as the policy regulating it in the EU contains no limits on expansion this reduces the extent to which it can be called a renewable resource. When production and consumption are on a global scale as they are today, so called 'biofuels' are more similar in nature to fossil fuels than to other renewable resources such as solar or wind. This issue is summarised effectively by the Executive Director of the Institute for European Environmental Policy (IEEP), David Baldock in the following statement:

> "EU biofuel policy must reflect the reality that while biomass in principle can be renewed, the overall quantity sustainably available is finite and must be shared across an emerging bioeconomy"

(Bowyer et al., 2014)

This paper has demonstrated that the current policy in fact does not reflect this reality of biomass and agrofuels. Regardless of the shortcomings of the sustainability criteria the use of targets is problematic in itself as it provides an incentive for governments to increase supply through the easiest option as opposed to the most sustainable. According to a study by the IEEP (2015) the use of such targets which are based on quantity rather than quality means that there is little support for technologies which are more sustainable but perhaps more expensive (Bowyer et al., 2015:16).

The other supposedly more sustainable alternative to the current first-generation agrofuels in use are second-generation agrofuels which are produced primarily from lignocellulosic feedstock which is what "makes up the majority of the cheap and abundant nonfood materials available from plants"

(Naik et al., 2010:579) and hence should provide a more sustainable alternative. However, the optimism towards second generation agrofuels as providing the answer to the failures of first generation ones should not be assumed without raising some questions. As research continues into their development GM microbes are being used to improve the process, this type of synthetic biology already has its critics and impacts may well currently be unknown and not necessarily positive (Econexus, 2007:6). As argued by Mitchell (2008), although they may be less harmful than first generation agrofuels, they are by no means on a level yet with the very positive policy expectations already cited by agrofuel supporters.

What is clear is that agrofuels are by no means the answer to the inter-linked crises in climate, energy, peak oil, development issues or agriculture. The only people benefitting from the agrofuel project are those in the business of agrofuels who now find they are able to work within a "huge and politically guaranteed market" (Pye, 2009:86) for agrofuels. A few at the top are gaining at the expense of the majority at the bottom who find themselves losing control over the land they live on and becoming increasingly marginalised.

Of course the EU and its agrofuels mandate cannot be blamed alone for the impacts of the now global agrofuels market. However with targets of 10% which under one estimate translates into "a volume of nine million tonnes of agrofuels" (Pye, 2009:86), it plays a central role and therefore needs to take a large portion of the responsibility for the global repercussions of its policy. This paper has shown that it is plausible to argue that agrofuels are not a solution to the problems of peak oil, energy security or environmental issues, as has been argued, but are in fact a part of these problems and in some cases are worsening them. In effect, the EU's policy allows it to shift the negative impacts from inside the EU to outside of the EU to those countries producing agrofuel feedstocks which are less developed and often have far less strict regulations in place. GHG emissions in the EU may technically have been reduced as a result of agrofuels but they are increasing in the countries of production. This allows the EU to meet its own targets, however, the fact is that many of these central issues such as climate change, energy security and reducing GHG emissions are global problems that need global responses if they are to be impacted, so the shifting of negative effects to countries outside the EU makes no overall impact on solving any of these problems.

This paper aimed to contribute to the growing amount of critical research and analyses into the current EU agrofuel agenda in order to hold such policies (and their advocates) accountable for the detrimental impacts they are causing. In effect, the paper has also contributed to the argument for the need of a "radical transformation" (Brunnengräber, 2015:82) of the current energy system based on fossil fuels and so called 'renewable energies' which, as this paper has shown, can in fact be as bad for the planet as fossil fuels, if not worse due to the social consequences they also have. The use of truly renewable and ecologically friendly sources of energy needs to be looked into, resources such as solar, wind and geothermal energy should be expanded even if this requires higher costs. Instead of continuing to subsidise agrofuels, money from governments should be spent on resources which reduce these impacts. Biomass can still play a part in energy production, however only if the most sustainable types are prioritised such as using waste to produce energy. If agrofuels are to continue to play any part in energy production the scale needs to be reduced significantly and in a best case scenario take place only on a local level.

References

ACP (2011). Secretariat ACP. Available at: http://www.acp.int/content/secretariat-acp [Accessed 23 June 2016].

AEBIOM (2015). AEBIOM statistical report 2015, European bioenergy outlook, key 2015 findings. Available at: http://www.aebiom.org/wp-content/uploads/2015/10/AEBIOM-Statistical-Report-2015_Key-Findings1.pdf [Accessed 31 May 2016].

Allen, B., Baldock, D., Nanni, S. & Bowyer, C. (2016). Sustainability criteria for biofuels made from land and non-land based feedstocks. Report for the European Climate Foundation. Institute for European Environmental Policy (IEEP), London. Available at: http://www.ieep.eu/publications/2016/05/sustainability-criteria-for-biofuels-post-2020 [Accessed 25 May 2016].

Al-Riffai, P., Dimaranan, B. & Laborde, D. (2010). Global trade and environmental impact study of the EU biofuels mandate. Report for the European Commission, ATLASS Consortium. Available at: http://environmentportal.in/files/biofuelsreportec.pdf [Accessed 3 June 2016].

Amnesty International (2008). *Amnesty International Report 2008. The state of the world's human rights*. London: Amnesty International International Secretariat. Available at: https://www.amnesty.org/en/documents/pol10/001/2008/en/ [Accessed 8 June 2016].

Banerjee, A.V. & Duflo, E. (2007). The economic lives of the poor. *The Journal of Economic Perspectives* [online], 21(1), pp. 141-168. Available at: http://erf.sbb.spk-berlin.de/han/sfx/www.jstor.org/stable/pdf/30033705.pdf?_=1465379655594 [Accessed 8 June 2016].

Basu, K. (2014). Foreword. In Zilberman, D. & Timilsina, G.R., eds. (2014). *The impacts of biofuels on the economy, environment, and poverty. A global perspective.* New York: Springer Science + Business Media, pp: 5-6.

Beckman, K. (2014). New German legislation will shake up the EU biofuels market - but how? *Energy Post.* 22 December 2014. Available at: http://www.energypost.eu/new-german-legislation-will-shake-eu-biofuels-market/ [Accessed 10 July 2016].

Beer, T., Grant, T. & Campbell, P.K. (2007). The greenhouse and air quality emissions of biodiesel blends in Australia. CSIRO. Available at: http://svc001.syd1-0021moss.server-web.com/Media%20Items/PressItem.1053.1552.pdf [Accessed 6 June 2016].

Bentsen, N. S. & Felby, C. (2012). Biomass for energy in the European Union - a review of bioenergy resource assessments. *Biotechnology for Biofuels* [online], 5(25). Available at: http://www.biotechnologyforbiofuels.com/content/5/1/25 [Accessed 11 April 2016].

Bilton, R. (2008). Hard graft: sugarcane for biofuel. *BBC News.* 21 November 2008. Available at: http://news.bbc.co.uk/2/hi/science/nature/7740397.stm [Accessed 8 June 2016].

BIOFRAC (2006). Biofuels in the European Union. A vision for 2030 and beyond. Final report of the Biofuels Research Advisory Council. Available at: https://ec.europa.eu/research/energy/pdf/draft_vision_report_en.pdf [Accessed 2 May 2016].

BirdLife Europe, ActionAid, ClientEarth, European Environmental Bureau, FERN, Friends of the Earth, Greenpeace European Unit, Transport & Environment & Wetlands International (2010). Driving to destruction: The impacts of Europe's biofuel plans on carbon emissions and land. Available at: http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2011%20pubs/1/driving-to-destruction-08-11-10.pdf [Accessed 25 May 2016].

Block, B. (2013). Global palm oil demand fueling deforestation. Worldwatch Institute [online]. Available at: http://www.worldwatch.org/node/6059 [Accessed 22 June 2016].

Bomb, C., McCormick, K., Deurwaarder, E. & Kåberger, T. (2007). Biofuels for transport in Europe: Lessons from Germany and the UK. *Energy Policy* [online]. 35(4), pp. 2256-2267. Available at: http://www.sciencedirect.com/science/article/pii/S0301421506002977 [Accessed 2 July 2016].

Borras, S.Jr. & Franco, J.C. (2009). Contemporary discourses and political contestations around pro-poor land policy and land governance. *Journal of Agrarian Change* [online], 10(1), pp. 1–32. Available at: https://www.researchgate.net/profile/Jennifer_Franco2/publication/227698264_Contemporary_Discourses_and_Contestations_around_ProPoor_Land_Policies_and_Land_Governance/links/54dc2a480cf28d3de65ed653.pdf [Accessed 10 June 2016].

Bowyer, C. (2011). Anticipated indirect land use change associated with expanded use of biofuels and bioliquids in the EU - an analysis of the national renewable energy action plans. IEEP. Available at: www.ieep.eu [Accessed 27 May 2016].

Bowyer, C., Baldock, D., Kretschmer, B. & Polakova, J. (2012). The GHG emissions intensity of bioenergy. Does bioenergy have a role to play in reducing Europe’s GHG emissions. IEEP. Available at: http://www.ieep.eu/publications/2012/10/ does-bioenergy-have-a-role-in-reducing-europe-s-ghg-emissions [Accessed 15 July 2015].

Bowyer, C., Baldock, D., Kretschmer, B. & Allen, B. (2014). Re-examining EU biofuels policy: A 2030 perspective. An IEEP discussion paper. Available at: http://www.ieep.eu/assets/1359/IEEP_re-examining_EU_biofuels_policy_-_A_2030_perspective.pdf [Accessed 10 July 2016].

Bowyer, C., Tucker, G., Nesbit, M., Baldock, D., Illes, A. & Paquel, K. (2015). Delivering synergies between renewable energy and nature conservation. Messages for policy making up to 2030 and beyond. A report for RSPB/ BirdLife Europe by the IEEP. Available at: http://www.ieep.eu/assets/1905/Final_25_Nov_RES.pdf [Accessed 10 July 2016].

Bringezu, S., Schütz, H., O’Brien, M., Kauppi, L., Howarth, R.W., & McNeely, J. (2009a). *Towards sustainable production and use of resources: Assessing Biofuels.* International Panel for Sustainable Resource Management, United Nations Environment Program. Available at: http://www.mtnforum.org/sites/default/files/publication/files/6287.pdf [Accessed 26 May 2016].

Bringezu, S., Schütz, H., Arnold, K., Merten, F., Kabasci, S., Borelbach, P., Michels, C., Reinhardt, G.A. & Rettenmaier, N. (2009b). Global implication of biomass and biofuel use in Germany - Recent trends and future scenarios for domestic and foreign agricultural land use and resulting GHG emissions. *Journal of Cleaner Production* [online]. 17(1), pp. S57-S68. Available at: http://www.sciencedirect.com/science/article/pii/S0959652609000973 [Accessed 2 July 2016].

Bringezu, S., O’Brien, M. & Schütz, H. (2012). Beyond biofuels: assessing global land use for domestic consumption of biomass. A conceptual and empirical contribution to sustainable management of global resources. *Land Use Policy* [online], 29(1) pp.224-232. Available at:

http://www.sciencedirect.com/science/article/pii/S0264837711000640 [Accessed 25 May 2016].

Brunnengräber, A. (2015). Bridging the gap with agrofuels. Energy hunger, energy scarcity and climate change in the European Union. In K. Dietz, B. Engels, O. Pye, & A. Brunnengräber, eds. (2015). *The political ecology of agrofuels*. Abingdon: Routledge. pp. 70-89.

Cochrane, J. (2016). Indonesia's orangutans suffer as fires rage and business grows. *The New York Times.* 5 April 2016. Available at: http://www.nytimes.com/2016/04/06/world/asia/indonesia-orangutan-borneo-fires.html?_r=0 [Accessed 4 July 2016].

Crutzen, P. J. (2002). Geology of mankind: the Anthropocene. *Nature* [online], 415(23). Available at: http://www.unife.it/scienze/lm.ecologia/Insegnamenti/management-degli-ecosistemi/materiale-didattico/Crutzen%202002.pdf [Accessed 28 April 2016].

Dauvergne, P. & K. Neville. (2009). The changing North-South and South-South political economy of biofuels. *Third World Quarterly* [online], 30(6), pp. 1087–102. Available at: http://courses.arch.vt.edu/courses/wdunaway/gia5524/dauv09.pdf [Accessed 10 June 2016].

Dicks, M.R., Campiche, J., De La Torre Ugarte, D., Hellwinckel, C., Bryant, H.L. & Richardson, J.W. (2009). Land use implications of expanding biofuel demand. *Journal of Agriculture and Applied Economics* [online], 41(2), pp.435-453. Available at: http://dx.doi.org/10.1017/S1074070800002911 [Accessed 31 May 2016].

Dietz, K., Pye, O., Engers, B. & Brunnengräber, A. (2015). An introduction to the political ecology of agrofuels. In K. Dietz, B. Engels, O. Pye & A. Brunnengräber, eds. (2015). *The political ecology of agrofuels*. Abingdon: Routledge. pp. 1-13.

Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. [2003] OJ L 123/42.

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directive 2001/77/EC and 2003/30/EC. [2009] OJ L 140/16.

Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 (on the quality of transport fuels) amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC. [2009] L 140/88.

Directive 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources. [2015] L 239/1.

EBFTP. (2016). Steering Committee membership, European Biofuels Technology Platform. Available from: http://www.biofuelstp.eu/steering.html#mems [Accessed 14 May 2016].

Econexus, Biofuelwatch, Carbon Trade Watch, Corporate Europe Observatory, Ecoropa, Grupo de Reflexión Rural, Munlochy Vigil, NOAH (Friends of the Earth Denmark), Rettet den Regenwald & Watch Indonesia (2007). Agrofuels: towards a reality check in nine key areas. Available from: http://www.econexus.info/pdf/Agrofuels.pdf [Accessed 16 May 2016].

Edwards, R., Szekeres, S., Neuwahl, F. & Mahieu, V. (2008). Biofuels in the European context: Facts and uncertainties. European Commission Joint Research Centre. Available at: http://foodsecurecanada.org/sites/default/files/jrc_biofuels_report.pdf [Accessed 20 June 2016].

EuropeAid (2009). Position paper on biofuels for the ACP-EU energy facility. Directorate-General for Development and Cooperation. Available at: http://web.archive.org/web/20131104020818/http://ec.europa.eu/europeaid/where/acp/regional-cooperation/energy/documents/biofuels_position_paper_en.pdf [Accessed 23 June 2016].

EurObserv'ER (2014). Biofuels Barometer. A study carried out by EurObserv'ER. July 2014. Available at: http://www.energies-renouvelables.org/observ-er/stat_baro/observ/baro222_en.pdf [Accessed 10 July 2016].

European Commission (2000). *Communication from the Commission on the precautionary principle,* 2 February 2000, COM(2000)1 final.

European Commission (2001). *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions on alternative fuels for road transportation and on a set of measures to promote the use of biofuels,* 7 November 2001, COM(2001) 547 final.

European Commission (2005). *Communication from the Commission to the Council and the European Parliament. Draft declaration on guiding principles for sustainable development,* 25 May 2005, COM(2005) 218 final.

European Commission (2006). *Communication from the Commission to the Council and the European Parliament. Biofuels Progress Report. Report on the progress made in the use of biofuels and other renewable fuels in the member states of the European Union*, 10 January 2007, COM(2006) 845 final.

European Commission (2012a). *Proposal for a directive of the European Parliament and of the Council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources*, 17 October 2012, COM(2012)595 final.

European Commission (2012b). *Commission staff working document, Impact assessment accompanying the document Proposal for a directive of the European Parliament and of the Council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources*, 17 October 2012, SWD(2012)343 final.

European Commission (2014a). *Commission Staff Working Document: State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU*, 28 July 2014, SWD(2014) 259 final.

European Commission (2014b). *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions - A policy framework for climate and energy in the period from 2020 to 2030*, 22 January 2014, COM(2014) 15 final.

European Commission (2015). *Report from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions - Renewable energy progress report,* 15 June 2015, COM(2015) 293 final.

Fabiosa, J. F., Beghin, J. C., Dong, F., Elobeid, J., Tokgoz, S., & Yu, T.-H. (2010). Land allocation effects of the global ethanol surge: Predictions from the international FAPRI model. *Land Economics* [online], *86*(4), pp.687–706. Available at: http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1509&context=card_workingpapers [Accessed 2 June 2016].

FAO (2008). *The state of food and agriculture 2008. Biofuels: prospects, risks and opportunities*. Rome. Available at: http://www.fao.org/docrep/011/i0100e/i0100e00.htm [Accessed 30 May 2016].

Farigone, J., Hill, j., Tilman, D., Polasky, S. & Hawthorne, P. (2008). Land clearing and the biofuel carbon debt. *Science* [online], 319(5867), pp. 1235-1238. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.333.8744&rep=rep1&type=pdf [Accessed 3 June 2016].

Farrell, A.E., Plevin, R.J., Turner, B.T., Jones, A.D., O'Hare, M. & Kammen, D.M. (2006). Ethanol can contribute to energy and environmental goals. *Science* [online], 311(5760), pp. 506-508. Available at: https://www.researchgate.net/profile/Daniel_Kammen/publication/7333318_Ethanol_can_contribute_to_energy_and_environmental_goals/links/0c96051755d8dc3d94000000.pdf [Accessed 4 June 2016].

Flach, B., Bendz, K. & Lieberz, L. (2014). EU biofuels annual 2014. Global Agricultural Information Network Report. Available at: http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_The%20Hague_EU-28_7-3-2014.pdf [Accessed 27 May 2016].

Flach, B., Lieberz, S., Rondon, M., Williams, B & Teiken, C. (2015). EU biofuels annual 2015. Global Agricultural Information Network Report. Available at: http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_The%20Hague_EU-28_7-15-2015.pdf [Accessed 27 May 2016].

Franco, J., Levidow, L., Fig, D., Goldfarb, L., Hönicke, M. & Mendonça, M.L. (2010). Assumptions in the European Union biofuels policy: frictions with experiences in Germany, Brazil and Mozambique. *The Journal of Peasant Studies* [online], 37(4), pp. 661-698. Available at: http://www.tandfonline.com/action/journalInformation?journalCode=fjps20 [Accessed 19 April 2016].

Frank, S., Böttcher, H., Havlík, P., Valin, H., Mosnier, A., Obersteiner, M., Schmid, E. & Elbersen, B. (2013). How effective are the sustainability criteria accompanying the European Union 2020 biofuel targets? *GCB Bioenergy* [online], 5(3), pp. 306-314. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1757-1707.2012.01188.x/full [Accessed 26 May 2016].

Gasparatos, A., Borzoni, M. & Abramovay, R. (2012). The Brazilian bioenthanol and biodiesel programs: drivers, policies, and impacts. In A. Gasparatos & P. Stromberg, eds. (2012). *Socioeconomic and environmental impacts of biofuels. Evidence from developing countries.* New York: Cambridge University Press, pp. 111-136.

Giuntoli, J., Agostini, A., Caserini, S., Lugato, E., Baxter, D. & Marelli, L. (2016). Climate change impacts of power generation from residual biomass. *Biomass and Bioenergy* [online], 89, pp: 146-158. Available at: http://www.sciencedirect.com/science/article/pii/S0961953416300459 [Accessed 25 May 2016].

Global Carbon Atlas (2015). Available at: http://www.globalcarbonatlas.org/?q=en/emissions [Accessed 4 July 2016].

Goldschmidt, K., Harrison, T., Holtry, M. & Reeh, J. (2013) Sustainable procurement: integrating classroom learning with university sustainability programs. *Decision Sciences Journal of Innovation Education* [online], 11(3), pp.279–294. Available at: http://onlinelibrary.wiley.com/doi/10.1111/dsji.12007/pdf [Accessed 9 June 2016].

Grethe, H., Deppermann, A. & Marquardt, S. (2013). Biofuels: effects on global agricultural prices and climate change. Institute of Agricultural Policy and Markets, Universität Hohenheim. Available at: http://www.boell.de/sites/default/files/biofuels_disk_papier2.pdf [Accessed 28 June 2016].

Gurgel, A., Reilly, J. M., & Paltsev, S. (2008). Potential land use implications of a global biofuels industry. Report No. 155. MIT Joint Program on the Science and Policy of Global Change. Available at: http://dspace.mit.edu/bitstream/handle/1721.1/41521/MITJPSPGC_Rpt155.pdf?sequence=1 [Accessed 31 May 2016].

Haberl, H., Sprinz, D., Bonazountas, M., Cocco, P., Desaubies, Y., Henze, M., Hertel, O., Johnson, R.K., Kastrup, U., Laconte, P., Lange, E., Novak, P., Paavo;a, J., Reenberg, A., van den Hove, S., Vermeire, T., Wadhams, P. & Searchinger, T. (2012). Correcting a fundamental error in greenhouse gas accounting related to bioenergy. *Energy Policy* [online] 45, pp.18-23. Available at: http://www.sciencedirect.com/science/article/pii/S0301421512001681 [Accessed 18 May 2016].

Harrison, P. (2010). Once-hidden EU report reveals damage from biodiesel. *Reuters.* 21 April 2010. Available at: http://www.reuters.com/article/us-eu-energy-biofuels-idUSTRE63K2CB20100421 [Accessed 15 June 2016].

Harrison, P. & Dunmore, C. (2010). EU report signals U-turn on biofuels target. *Reuters.* 25 March 2010. Available at: http://www.reuters.com/article/us-eu-energy-biofuels-idUSTRE62O3O420100325 [Accessed 15 June 2016].

Hennecke, A.M., Faist, M., Reinhardt, J., Junquera, V., Neeft, J. & Fehrenbach, H. (2013). Biofuel greenhouse gas calculations under the European Renewable Energy Directive - A Comparison of the BioGrace tool vs. The tool of the Roundtable on Sustainable Biofuels. *Applied Energy* [online], 102, pp. 55-62. Available at: http://www.sciencedirect.com/science/article/pii/S0306261912003066 [Accessed 30 May 2016].

Hiederer, R., Ramos, F., Capitani, C., Koeble, R., Blujdea, V., Gomez, O., Mulligan, D. & Marelli, L. (2010). Biofuels: a new methodology to estimate GHG emissions from global land use change. A methodology involving spatial allocation of agricultural land demand and estimation of CO2 and N2O emissions. Available at: http://www.indiaenvironmentportal.org.in/files/GHG_emissions_from_global_land_use_change.pdf [Accessed 2 June 2016].

Hochman, G., Rajagopal, D., Timilsina, G.R. & Zilberman, D. (2014). Impacts of Biofuels on Food Prices. In D. Zilberman & G.R. Timilsina, eds. (2014). *The impacts of biofuels on the economy, environment, and poverty. A global perspective.* New York: Springer Science + Business Media, pp. 47-64.

Hunsberger, C. (2015). The discursive and material flexibility of *Jatropha curcas.* In D. Kristina, B. Engels, O. Pye, & A. Brunnengräber, eds. (2015). *The political ecology of agrofuels*. Abingdon: Routledge. pp. 132-147.

Jackson, T. (2010). Prosperity without growth. The transition to a sustainable economy. Sustainable Development Commission [online]. Available at: http://moodle.hwr-berlin.de/course/view.php?id=19720 [Accessed 17 January 2016].

Keating, D. (2015). EU caps "bad" biofuels. *POLITICO*. 28 April 2015. Available at: http://www.politico.eu/article/eu-caps-bad-biofuels/ [Accessed 23 June 2016].

Koplin, J., Seuring, S. & Mesterharm, M. (2007). Incorporating sustainability into supply management in the automotive industry—the case of the Volkswagen AG. *Journal of Cleaner Production* [online], 15(11), pp. 1053–1062. Available at: http://www.sciencedirect.com/science/article/pii/S0959652606002459 [Accessed 9 June 2016].

Laborde, D. (2011). Assessing the land use change consequences of European biofuel policies. Report for the European Commission, ATLASS Consortium. Available at: http://trade.ec.europa.eu/doclib/docs/2011/october/tradoc_148289.pdf [Accessed 3 June 2016].

Ladanai, S. & Vinterbäck, J. (2009). Global potential of sustainable biomass for energy. Swedish University of Agricultural Sciences, Department of Energy and Technology, Report 013. Available at: http://pub.epsilon.slu.se/4523/1/ladanai_et_al_100211.pdf [Accessed 20 March 2016].

Levidow, L. (2001). Precautionary uncertainty: regulating GM crops in Europe. *Social Studies of Science* [online]. 31(6), pp. 845–878. Available at: http://erf.sbb.spk-berlin.de/han/sfx/www.jstor.org/stable/3182946?seq=1#page_scan_tab_contents [Accessed 29 April 2016].

Levidow, L. (2012). EU criteria for sustainable biofuels: Accounting for carbon, depoliticising plunder. *Geoforum* [online], 44, pp. 211-223. Available at: http://www.sciencedirect.com/science/article/pii/S001671851200190X [Accessed 29 April 2016].

Lih Yi, B. (2016). New haze fears as palm oil firms ditch Indonesia pact. *Thomson Reuters Foundation,* 5 July 2016. Available at: http://news.trust.org/item/20160705111445-j2og9/?source=hpOtherNews3 [Accessed 4 July 2016].

Lohmann, L. (2011). The endless algebra of climate markets. *Capitalism Nature Socialism* [online], 22(4), pp. 93-116. Available at: http://dx.doi.org/10.1080/10455752.2011.617507 [Accessed 10 June 2016].

Macedo, I., Lima M. R, Leal V. & Azevedo Ramos da Silva, J. E. (2004) Assessment of greenhouse gas emissions in the production and use of fuel ethanol in Brazil. Government of the State of São Paulo, São Paulo, Brazil. Available at: https://www.wilsoncenter.org/sites/default/files/brazil.unicamp.macedo.greenhousegas.pdf [Accessed 4 June 2016].

Magdoff, F. (2008). The political economy and ecology of biofuels. *Monthly Review* [online], July-August, pp. 34-50. Available at:

http://search.proquest.com/openview/9d4b0f75cc09d3aa93a168aa3779075c/1?pq-origsite=gscholar [Accessed 19 June 2016].

Markevičius, A., Katinas, V., Perednis, E. & Tamašauskienė, M. (2010). Trends and sustainability criteria of the production and use of liquid biofuels. *Renewable and Sustainable Energy Reviews* [online], 14(9), pp. 3226–3231. Available at: http://www.sciencedirect.com/science/article/pii/S1364032110001954 [Accessed 25 May 2016].

McDonnell, P.J. (2008). Human costs of Brazil's biofuels boom. *Los Angeles Times.* 16 June 2008. Available at: http://www.latimes.com/world/la-fg-biofuels16-2008jun16-story.html [Accessed 8 June 2016].

Mendonça, M.L. (2009). Impacts of expansion of sugarcane monocropping for ethanol production. In E. Sydow & M.L. Mendonça eds. (2008). Human Rights in Brazil 2008. A report by the Network for Social Justice and Human Rights. Available at: https://www.prisonlegalnews.org/media/publications/network_for_social_justice_and_human_rights_brazil_human_rights_report_2008.pdf#page=63 [Accessed 8 June 2016].

Mitchell, D. (2008). A note on rising food prices, Policy Research Working Paper 4682, Development Prospects Group, The World Bank. Available at: http://www.fbae.org/2009/FBAE/website/images/PDF%20files/biofuels/The%20World%20Bank%20Biofuel%20Report.pdf [Accessed 23 June 2016].

Naik, S.N., Goud, V.V., Rout, P.K. & Dalai, A.K. (2010). Production of first and second generation biofuels: a comprehensive review. *Renewable and Sustainable Energy Review* [online], 14(2), pp. 578-597. Available at: https://www.researchgate.net/profile/Satya_Naik3/publication/222820186_Production_of_first_and_second_generation_biofuels_a_comprehensive_review_Renew_Sustain_Energy_Rev/links/0c96052cd85f0be3ee000000.pdf [Accessed 19 May 2016].

Naylor, R.L., Liska, A., Burke, M.B., Falcon, W.P., Gaskell, J.C., Rozelle, S.D. & Cassman, K.G. (2007). The ripple effect: biofuels, food security, and the environment. *Environment* [online], 49(9), pp. 30-43. Available at: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1386&context=agronomyfacpub [Accessed 25 April 2016].

Ortiz, F. (2014). Face of slave labour changing in Brazil. *Inter Press Service News Agency.* 30 April 2014. Available at: http://www.ipsnews.net/2014/04/face-slave-labour-changing-brazil/ [Accessed 8 June 2016].

Pavlovskaia, E. (2013). Using Sustainability Criteria in Law. *International Journal of Environmental Protection and Policy* [online], 1(4), pp. 76-78. Available at: https://works.bepress.com/evgenia_pavlovskaia/10/ [Accessed 6 June 2016].

Pavlovskaia, E. (2014). Sustainability criteria: their indicators, control, and monitoring (with examples from the biofuel sector). *Environmental Sciences Europe* [online], 26(17), pp. 1-12. Available at: http://www.enveurope.com/content/26/1/17 [Accessed 6 June 2016].

Phillips, T. (2007). Brazil’s ethanol slaves: 200,000 migrant sugar cutters who prop up renewable energy boom. *The Guardian.* 9 March 2007. Available at: https://www.theguardian.com/world/2007/mar/09/brazil.renewableenergy [Accessed 30 May 2016].

Pichler, M. (2010). Agrofuels in Indonesia: structures, conflicts, consequences, and the role of the EU. *Austrian Journal of South-East Studies* [online]. 3(2), pp. 175-193. Available at: https://aseas.univie.ac.at/index.php/aseas/article/viewFile/394/198 [Accessed 22 June 2016].

Pichler, M. (2011). Palm oil and agrofuels in South-East Asia - a political ecology framework for studying human-nature interactions and the role of the state. International Conference on International Relations and Development. Available at: https://www.researchgate.net/profile/Melanie_Pichler/publication/266871143_Palm_Oil_and_Agrofuels_in_South-East_Asia_-_A_Political_Ecology_Framework_for_Studying_Human-Nature_Interactions_and_the_Role_of_the_State/links/551bc4390cf2fe6cbf75e60c.pdf [Accessed 22 June 2016].

Pichler, M. (2015). Legal dispossession: state strategies and selectivities in the expansion of Indonesian palm oil and agrofuel production. *Development and Change* [online], 46(3), pp. 508–533. Available at: http://onlinelibrary.wiley.com/doi/10.1111/dech.12162/abstract?userIsAuthenticated=false&deniedAccessCustomisedMessage= [Accessed 22 June 2016].

Pye, O. (2009). Palm Oil as a Transnational Crisis in South-East Asia. *ASEAS – Austrian Journal of South- East Asian Studies* [online]. *2*(2), pp. 81-101. Available at: https://aseas.univie.ac.at/index.php/aseas/article/viewFile/507/347 [Accessed 22 June 2016].

Reinhardt, G., Rettenmaier, N. & Köppen, S. (2008). How sustainable are biofuels for transportation? “Bioenergy: Challenges and Opportunities” International Conference and Exhibition on Bioenergy, April 6th-9th 2008, Guimarães, Portugal. Available at: http://ifeu.de/landwirtschaft/pdf/biofuels_Guimaraes_Conf.pdf [Accessed 7 June 2016].

Ribeiro, D. & Matavel, N. (2009). Jatropha! A socio-economic pitfall for Mozambique. Justiça Ambiental & União Nacional de Camponeses (UNAC), Maputo. Available at: https://viacampesina.net/downloads/PDF/Report-Jatropha-JA-and-UNAC.pdf [Accessed 10 June 2016].

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S.III, Lambin, E. , Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H. Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. & Foley J. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society* [online], 14(2): 32. Available at: http://www.ecologyandsociety.org/vol14/iss2/art32/ [Accessed 30 March 2016].

Rosillo-Calle, F. & Tschirley, J. (2010). Food versus fuel: setting the scene. In F. Rosillo-Calle & F.X. Johnson, eds. (2010). *Food vs fuel: an informed introduction to biofuels*. London, New York: Zed Books, pp. 7-28.

Schlegel, S. & Kaphengst, T. (2007). European Union policy on bioenergy and the role of sustainability criteria and certification systems. *Journal of Agricultural & Food Industrial Organization* [online], 5(7), pp. 1-17. Available at: http://np-net.pbworks.com/f/Schlegel+%26+Kaphengst+(2007)+EU+policy+and+bioenergy,+role+of+sustainability+criteria+and+certification.pdf [Accessed 12 April 2016].

Searchinger, T., Heimlich, R., Houghton, R.A., Dong, F., Elobeid, A., Fabiosa, J., Tokgoz, S., Hayes, D. & Yu, T-H. (2008). Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change. *Science* [online], 319(5867), pp. 1238-1240.

Available at:http://www.energyjustice.net/files/ethanol/ghg/2008-Searchinger-Science-1238-40.pdf [Accessed 3 June 2016].

Sharman, A. & Holmes, J. (2010). Evidence-based policy or policy-based evidence gathering? Biofuels, the EU and the 10% target. *Environmental Policy and Governance* [online], 20(5), pp. 309-321. Available at: http://onlinelibrary.wiley.com/doi/10.1002/eet.543/abstract [Accessed 20 May 2016].

Silva Lora, E.E., Escobar Palacio, J.C., Rocha, M.H., Grillo Renó, M.L., Venturini, O.J. & Almazán del Olmo, O. (2011). Issues to consider, existing tools and constraints in biofuels sustainability assessments. *Energy* [online], 36(4), pp. 2097-2110. Available at: http://www.sciencedirect.com/science/article/pii/S0360544210003336 [Accessed 17 April 2016].

Simpson, D. & Power, D.J. (2005). Use the supply relationship to develop lean and green suppliers. *Supply Chain Management: An International Journal* [online], 10(1), pp.60-68. Available at: http://www.emeraldinsight.com/doi/abs/10.1108/13598540510578388 [Accessed 9 June 2016].

Soimakallio, S. & Koponen, K. (2011). How to ensure greenhouse gas emission reduction by increasing the use of biofuels? - Suitability of the European Union sustainability criteria. *Biomass and Bioenergy* [online], 35(8), pp. 3504-3513. Available at: http://www.sciencedirect.com/science/article/pii/S0961953411002431 [Accessed 12 April 2016].

Steffen, W., Crutzen, P. J. & McNeill, J. R. (2007). The Anthropocene: are humans now overwhelming the great forces of Nature? *Ambio* [online], 36, pp:614–621. Available at: https://www.researchgate.net/profile/John_Mcneill4/publication/5610815_The_Anthropocene_Are_Humans_Now_Overwhelming_the_Great_Force_of_Nature_Ambio_A_J_Human_Environ/links/0fcfd511e373d55e47000000.pdf [Accessed 28 April].

Steinbuks, J. & Timilsina, G.R. (2014). Land-use change and food supply. In D. Zilberman & G.R. Timilsina, eds. (2014). *The impacts of biofuels on the economy, environment, and poverty. A global perspective.* New York: Springer Science + Business Media, pp. 91-102.

Timilsina, G.R. & Mevel, S. (2014). Biofuels and climate change mitigation. In D. Zilberman & G.R. Timilsina, eds. (2014). *The impacts of biofuels on the economy, environment, and poverty. A global perspective.* New York: Springer Science + Business Media, pp. 111-122.

van Dam, J., Junginger, M. & Faaij, A.P.C. (2010). From the global efforts on certification of bioenergy towards an integrated approach based on sustainable land use planning. *Renewable and Sustainable Energy Reviews* [online], 14(9), pp. 2445-2472. Available at: http://www.sciencedirect.com/science/article/pii/S1364032110001905 [Accessed 15 May 2016].

van Dam, J. & Junginger, M. (2011). Striving to further harmonization of sustainability criteria for bioenergy in Europe: Recommendations from a stakeholder questionnaire. *Energy Policy* [online], 39(7), pp. 4051-4066. Available at: http://www.sciencedirect.com/science/article/pii/S0301421511002023 [Accessed 15 May 2016].

Varkkey, H. (2012). The growth and prospects for the oil palm plantation industry in Indonesia. *Oil Palm Industry Economic Journal* [online], 12(2). Available at: https://umexpert.um.edu.my/file/publication/00009140_85384.pdf [Accessed 16 June 2016].

Vogelpohl, T. (2015). Immunization by neoliberalism: the strange non-death of the win-win narrative in European agrofuel policy. In D. Kristina, B. Engels, O. Pye, & A. Brunnengräber, eds. (2015). *The political ecology of agrofuels*. Abingdon: Routledge. pp. 236-252.

Wallbaum, H., Krank, S. & Teloh, R. (2010). Prioritizing sustainability criteria in urban planning processes: methodology application. *Journal of Urban Planning Development* [online], 137(1), pp.20–28. Available at: http://ascelibrary.org/doi/pdf/10.1061/(ASCE)UP.1943-5444.0000038 [Accessed 2 June 2016].

White, B. & Dasgupta, A. (2010). Agrofuels capitalism; a view from political economy. *The Journal of Peasant Studies* [online]. 37(4), pp.593-607. Available at: http://dx.doi.org/10.1080/03066150.2010.512449 [Accessed 15 May 2016].

White, B., Park, C.M. & Julia (2015). The gendered political ecology of agrofuels expansion. In K. Dietz, B. Engels, O. Pye & A. Brunnengräber, eds. (2015). *The political ecology of agrofuels*. Abingdon: Routledge. pp. 53-69.

Wilkinson, J. & Herrera, S. (2010). Biofuels in Brazil: debates and impacts. *The Journal of Peasant Studies* [online], 37(4), pp. 749-768. Available at: http://dx.doi.org/10.1080/03066150.2010.512457 [Accessed 8 June 2016].

Zink, K.J. (2005). From industrial safety to corporate health management. *Ergonomics* [online],48(5), pp. 534-546. Available at: http://www.tandfonline.com/doi/abs/10.1080/00140130400029266 [Accessed 9 June 2016].

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