ANALYSIS OF THE UNCERTAINTIES OF THE INCLUSION OF INDIRECT LAND USE CHANGE INTO THE EUROPEAN UNION RENEWABLE ENERGY SOURCES DIRECTIVE II

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ABSTRACT

Indirect land use change (ILUC) occurs when vegetable oils which were previously used for food are now also used as fuels, which compels more land to be cleared to fulfil this additional demand. This article analyses the uncertainties and biasness of the inclusion of ILUC into the European Union Renewable Energy Sources Directive (EU RED) II especially towards palm oil. The consideration of a feedstock globally instead of regions penalises sustainable producers of a feedstock. Loading a detrimental projected deforestation percentage on palm oil based on limited publication with high uncertainties is not acceptable. Disregarding the increasing forest cover in Malaysia now at 55.6% due to Malaysian government pledge and intervention to maintain at least 50% of the country as forest cover seems unfair. Projections were based on historical data which contradicts developments and improvements which never follows historical data or events. In terms of oil yield, palm oil is 5.56, 10.53 and 7.84 times more productive than rapeseed, soyabean and sunflower oil, respectively. To substitute one million tonnes of palm oil which can be produced in 250 000 ha yr⁻¹ will require soyabean, rapeseed and sunflower oil 2 632 500, 1 390 000 and 1 960 000 ha yr⁻¹ respectively which will increase the greenhouse gas (GHG) emissions from the land use change and ILUC for these crops as well. National sustainability certifications need to be supported by EU to fill the gap and to be recognised to certify the low ILUC risk and additionality. Generally, many components of the Commission Delegated Regulation are very restrictive to palm oil and are presented without clear scientific evidence which appears to be targeted at disqualifying the use of palm oil as biofuel. This can be construed as a form of trade protectionism and more politically driven rather than science.

INTRODUCTION

Climate change and environmental degradation have pushed most countries to adopt policies that will help restore or negate the negative impacts that are affecting the environment. One such policy that most governments started adopting was policy to substitute the use of fossil fuels (Broch *et al.*, 2013). These policies which were basically biofuel policies required the utilisation of biofuels that have a lower greenhouse gas (GHG) emissions as compared to fossil fuels. The GHG emissions

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reductions requirements were calculated based on the Life Cycle Assessment (LCA) approaches and this brought about a huge move globally towards the use of biofuels (Broch *et al.*, 2013). At that point biofuels were seen as the green fuel of the future to assist in the reduction of the use of fossil fuels.

Oil crop manufacturers also seized the opportunity to convert the oils into methyl esters for use as biofuels resulting to the publication of many studies (Ma and Hanna, 1999; Demirbas, 2005; Barnwal *et al.*, 2005; Patil and Deng, 2009). The full cradle to grave LCA for these oil crop-based biofuels considered all the direct emissions right from land use change, raw material extraction till the use and combustion of the biofuels and was proved to have a lower GHG emissions as compared to fossil fuels (Broch *et al.*, 2013). This brought about a huge move globally towards using these biofuels which were more environmental-friendly while still being able to perform like fossil fuels (Mekhilef *et al.*, 2011). The Malaysian oil palm industry just like the other oils and fats industry also ventured into the palm biodiesel programme in the 2000s. In 2011, Malaysia launched its first B5 programme aiming for palm oil to also play its part towards the national and global GHG emissions reduction (Nathan, 2011; MPOB, 2011).

While the use of the biofuels was gaining momentum globally, a study by Searchinger *et al.* (2008) discussed about the food versus fuel dilemma. The concern was that the oils previously used for only food applications were now also being used as fuels. This was the first study that introduced the concept of how the demand for a certain feedstock previously used for food, suddenly has competing demand to be used as fuel, can cause disruptions in food security. More land needs to be cleared to fulfil this additional demand caused by biofuels. Thus, the concept of indirect land use change (ILUC) was born.

The study by Searchinger *et al.* (2008) proposed to add an indirect factor or penalty caused by the ILUC to the GHG emissions for the biofuels. This made the final GHG emissions of biofuels to be higher than fossil fuels and statements and headlines that biofuels are now worse than fossil fuels (Finkbeiner, 2014) emerged. This was when the green biofuels suddenly became the environment's worst enemy.

In spite of the scientific community disagreeing with the method of the inclusion of the indirect effects of ILUC (Mathews and Tan, 2009; Finkbeiner, 2014; Brinkman *et al.*, 2018), this did not stop policy-makers to create policies to include ILUC. The pioneer to do so was the United States of America (USA) which included ILUC for their US Renewable Fuel Standards (RFS 2) in 2010 and California's Low Carbon Fuel Standard (LCFS) in 2011. Here the legislation used the ILUC modelled factor to be loaded into the traditional LCA calculations to determine the final GHG emissions for the various feedstocks (US EPA, 2010; CARB, 2011).

Breetz (2017) analysed the decision of the United States Environmental Protection Agency (EPA) to include the ILUC in the RFS 2 and discovered a paradox in the use of science and understanding. The study discovered that the inclusion of ILUC was more politically driven rather than being scientific. The study concluded that political dimensions were equally important in understanding the decision for the inclusion of the unscientific proponents of ILUC into legislations and policies (Breetz, 2017).

For years, the European Union (EU) has been debating regarding the inclusion of ILUC into their Renewable Energy Sources Directive, referred to as the RED. On 14 June 2018, the Council of the EU, the European Parliament and the European Commission reached a political agreement during their inter-institutional trilogue negotiations to include ILUC into the revised RED II.

The European Commission then published a Commission Delegated Regulation which described the occurrence of the ILUC. According to the Commission Delegated Regulation, when land that was previously intended to be used to produce feedstock for food is used to supply biofuel instead does not eliminate the demand for food. The demand for food still remains. This causes more land to be cleared elsewhere to supply for the demand of the feedstock for food that has been taken up by biofuel. The land cleared to meet this demand can cause the excess release of GHG emissions even more if that land cleared is from high carbon stock areas such as forests, wetlands and peatlands. The GHG emissions can be so significant that it could negate some or all of the GHG emission savings of individual biofuels (European Commission, 2019a, b).

The RED II does not yet include an express *ban* of palm oil-based biofuels. Rather, it hides the potential *ban* of palm oil-based biofuels behind rules that will apply to all biofuel crops. More specifically, Article 26(2) of the RED II on 'Specific rules for biofuels, bioliquids and biomass fuels produced from food and feed crops' calls for the determination of low ILUC risk biofuels. According to the Commission Delegated Regulation, if a feedstock is a high ILUC risk biofuel than it would not be able to be imported as biofuels into the EU.

It is a known fact that the biofuels' GHG emissions will be severely impacted with the inclusion of ILUC (Brinkman *et al.*, 2018). Mitigating ILUC risk is important to avoid additional GHG emissions as compared to fossil fuels (Brinkman *et al.*, 2018). However, this should be carried out in a more reliable and scientific manner. Generally, many components of the Commission Delegated Regulation are very restrictive to palm oil and are prepared and presented without clear scientific evidence. The Commission Delegated Regulation

appears to be targeted at disqualifying the use of palm oil as biofuel, which can be construed as a form of trade protectionism.

This article analyses the uncertainties that revolves around the inclusion of ILUC into the EU RED II especially towards palm oil. The Commission Delegated Regulation on the high and low ILUC risk biofuels was analysed for its scientific robustness, transparency, uncertainties and biasness if any.

METHODOLOGY

A desktop study was conducted to review and analyse the uncertainties in the Commission Delegated Regulation on high and low ILUC risk biofuels under the Recast of the Renewable Energy Directive (European Commission, 2019a) and the Annex (European Commission, 2019b). The *Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Status of Production Expansion of Relevant Food and Feed Crops Worldwide* which was cited in the Commission Delegated Regulation was also analysed (European Commission, 2019c).

The Commission Delegated Regulation is mostly addressing two fundamental issues related to ILUC as follows:

i) Determining if the feedstock is of high ILUC risk for which a significant expansion of the production area into land with high carbon stock is observed; and

ii) Certifying low ILUC risk biofuels, bio-liquids and biomass fuels.

The study analysed the various uncertainties arising from these fundamental issues.

RESULTS AND DISCUSSION

The science behind ILUC is still in its infancy and there are no international accounting standards available like for the LCA and carbon footprint which have matured over a few decades (Finkbeiner, 2014). There is substantial research and heated debate on ILUC both scientifically and politically due to the differences and inconsistencies (Edwards *et al.*, 2010; Debucquet, 2011).

Put together, the high stakes, enormous uncertainties, and asymmetrical LCA boundaries made ILUC intensely politicised (Breetz, 2009). According to Gawel and Ludwig (2011) due to the wide variance of scientific results it is not defensible to build political decisions on ILUC outcomes. It was stated that science will not serve as a predictive oracle to guide policy choices (Lucia *et al.*, 2011).

Further prove of how politically driven was the ILUC inclusion can be seen when the decisions were influenced by trade deals as can be seen in the report by Blenkinsop and Renshaw (2019) where the European Commission concluded that US soyabeans can be used in biofuels in the European Union, part of the bloc's push to improve strained trade relations with the United States. The Commission said in a statement the recognition of US soyabeans for use in biofuels was valid until 1July 2021, but could extend beyond that date as long as they met sustainability criteria set in new EU rules in the 2021-2030 period (Blenkinsop and Renshaw, 2019).

The Commission Delegated Regulation on high and low ILUC risk biofuels under the Recast of the Renewable Energy Directive was adopted by the European Commission on 13 March 2019 (European Commission, 2019a). This happened just within five days after the closing date for public comments on the delegated regulation. There were thousands of comments submitted to the European Commission online during the one-month public comments period which ended on 8 March 2019 (European Commission, 2019a).

Consideration of Feedstocks by Region

By definition, in geography, regions are areas that are broadly divided by physical characteristics, human impact characteristics, and the interaction of humanity and the environment (Bailey, 1996). A region has its own nature that could not be moved. The first nature is its natural environment (landform, climate, *etc.*). The second nature is its physical elements complex that were built by people in the past. The third nature is its socio-cultural context that could not be replaced by new immigrants (Bailey, 1996). Regions are divided because there exist distinctive differences as in the definition. But the consideration of the feedstock in the Commission Delegated Regulation does not consider this and categorises feedstocks globally.

This is one of the main reasons why during the stakeholder consultation on 19 November 2018, there was a split in the decision to either consider regional differences or a global approach when categorising if a feedstock has a high or low ILUC risk. In spite of the split, the Commission Delegated Regulation still adopted the global approach to determine if a feedstock is high or low ILUC risk. The global approach is flawed as it does not consider regional differences such as climate, land type, land cover, soil conditions, water availability, human practices, technology developments, and much more. This approach also gives no room for those existing players or players who will not expand into high carbon stock areas. There should be provisions for feedstock to be categorised by region and if the feedstock is coming from a region with no possible expansion into high carbon stock land, then the feedstock from this region should be categorised as

low risk biofuels. If a feedstock has new expansion into high carbon stock areas in certain regions which only accounts for a certain percentage of the available feedstock, it is not fair to categorise the whole lot of the feedstock as high risk biofuel. Instead the respective feedstock should be categorised by region and categorised as low risk biofuels if it comes from a certain region like Peninsular Malaysia. Here the oil palm have been cultivated before 2008 (Kushairi *et al*., 2018) and there is no room for expansion into high carbon stock areas. Such oil palms cultivated in these types of regions should be categorised as low risk biofuels. The region should be tagged along with the feedstock and not globally. There was a study by Brinkman *et al.* (2017) that multiple measures exist to reduce the risk of ILUC. But these measures and their potential to mitigate ILUC are not yet well understood. Therefore, we assessed the ILUC-mitigation potential under three scenarios for possible developments in agricultural production and supply chains for a case study on maize production in Hungary for ethanol. Our results show that ILUC-risk mitigation is possible in all three scenarios: agricultural land demand is reduced by 3500-16 000 km² in 2020 compared to the current situation (6%-29%) of the agricultural area that showed how the ethanol production from maize from Hungary could qualify as low risk biofuel feedstock due to no prospects for future expansion on high carbon stock areas but the additional demand for biofuels could be supplied by the increase in yield.

This case will be similar for oil palm from Peninsular Malaysia. Most of these plantations covering about 2.72 million hectares were cultivated between the years 1970s and 1990s (Kushairi *et al*., 2018). Furthermore, high yielding planting materials are being planted to increase the yields.

The interesting fact is, the forest cover in Malaysia is increasing. This is mainly due to government interventions and conservation efforts. The Malaysian government has pledged to maintain at least 50% of the country as forest cover. In 2014, after taking into account Land Use, Land-Use Change and Forestry (LULUCF) emissions only, the GHG emission intensity per unit of GDP has improved by approximately 27% as compared with 2005 levels. With the inclusion of removals by LULUCF, the GHG emission intensity per unit GDP had improved 33% by 2014 compared with 2005 levels (Ministry of Energy, Science, Technology, Environment & Climate Change, 2018). *Table 1* (Ministry of Water, Land and Natural Resources, 2018) shows the forested and non-forested areas in Malaysia from 2013-2017. *Table 2* (Ministry of Energy, Science, Technology, Environment & Climate Change, 2018) shows the total forested areas in Malaysia.

With the intervention of government policies and conservation efforts, palm oil specifically from Peninsular Malaysia can definitely qualify to be a low ILUC risk biofuel feedstock. However, the Commission Delegated Regulation categorises feedstocks without the consideration of the region. This unfairly disqualifies palm oil from all regions irrelevant if the region has the best conservation and sustainability practices or policies to govern the forest. This shows the extreme biasness of the Commission Delegated Regulation to unfairly penalise the sustainable palm oil producers.

Combating Deforestation

The propagators of ILUC generally imply that this is a measure to combat deforestation. In the Commission Delegated Regulation, the assessment

TABLE 1. FORESTED AND NON-FORESTED AREAS, MALAYSIA (2013-2017)

Country	Year	Forested (ha)	%	Non-forested (ha)	%
Malaysia	2013	18 062 091	54.8	14 881 849	45.2
	2014	18 273 201	55.5	14 639 166	44.4
	2015	18 389 686	55.8	14 554 254	44.2
	2016	18 241 716	55.4	14 702 224	44.6
	2017	18 323 502	55.6	14 844 874	45.1

TABLE 2. TOTAL FORESTED AREAS (million hectares)

Year	Peninsular Malaysia	Sabah	Sarawak	Total
1990	6.270	4.440	8.072	18.782
1995	5.861	4.420	7.675	17.956
2000	5.915	4.420	7.861	18.196
2005	5.830	4.360	7.624	17.815
2010	5.864	4.436	7.627	17.927
2011	5.807	4.436	7.688	17.931
2012	5.789	4.429	7.795	18.013
2013	5.831	4.430	7.795	18.056
2014	5.803	4.440	8.034	18.277

period between 2008 and 2016 may not provide comparable or fair estimation on oil palm expansion. If there had been major expansions into high carbon stock areas for other crops before this assessment period, these conversions have not been considered. Loss of forest has the same effect irrelevant of the time it was cleared.

In the Commission Delegated Regulation, the Annex (European Commission, 2019b) on worldwide production expansion on food and feed crop loaded palm oil with a 45% deforestation rate.

The same Annex showed an expansion of 4027.5 kha for maize since 2008 as compared to oil palm which was only 702.5 kha. Maize is having a much bigger share in the land expansion but is not considered to be contributing towards ILUC but oil palm has been loaded with 45% on deforestation. On further exploration the figures were derived from (Vijay *et al.*, 2016) cited in the *Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Status of Production Expansion of Relevant Food and Feed Crops Worldwide*. According to the report, the Vulnerable Forest Assessment was used to derive the deforestation value. The study predicts reduction in forests based on the mean climate model projection for 2080. There are huge uncertainties in the outcome of such models because both climate and agriculture models are required to project the outcome. Furthermore, the climate model used is a global model and not specific to regions. This would give higher errors as compared to the use of the South-east climate models which were not used in this study to evaluate land conversion projections in South-east Asia.

The suitability model values in the study ranges from 1-100 where 100 represents the most suited area for oil palm cultivation. However, the study then decided to choose the value 30 to make the predictions on suitable areas for oil palm to be grown (Vijay *et al.*, 2016). This can influence a high degree of uncertainty in the projection of the areas where future oil palm expansion can occur.

Vijay *et al*. (2016) clearly stated that their predictions are based on limited available historic high-resolution imagery. The authors stated that the study could not clearly determine the specific land cover conversions that ultimately lead to oil palm cultivation. The study also reiterated that it lacked data needed to decide if oil palm expansion was directly responsible for deforestation or was used for some other development. A caveat was also made by the authors stating that FAO statistical data was used to give weightage for each country and this can cause huge variations due to the reported data accuracy among the countries (Vijay *et al.*, 2016). The authors clearly stated on the various limitations and assumptions used for the study. A different choice of variables and assumptions could have influenced a completely different outcome and percentage. Without considering all these, the Commission Delegated Regulation Annex decided to put a detrimental projected deforestation value for oil palm which seems to be totally biased, unfair and unsubstantiated

ILUC Projections

All projections of the land use change that will occur in the ILUC projections are based on historical data. For the European Union Renewable Energy Sources Directive II (EU RED II) specifically a cut off period of 2008 was chosen. A comparative assertion of oil palm expansion with other vegetable oils at this time frame or even as far as the 2000s will not be a fair comparison. There could have been even more damaging expansions by other crops or for other uses prior to the evaluation period which fails to give the true comparison of palm oil being categorised as a high risk biofuel. Projections are based on historical data, but the reality is that change is inevitable. The only constant thing is change. So how can historical data determine the future projections? In reality all developments and improvements in technologies, practices and breakthroughs never follow historical data or events. If history keeps repeating, then there will be no room for development or improvements. This is the reason the status of a feedstock in the future should not be based on its performance in the past. The fundamentals of these projections itself are flawed.

Yield Considerations

Land is normally classified according to their carbon stock. Even the Intergovernmental Panel on Climate Change (IPCC) categorises lands according to their carbon stocks in tonnes per hectare. The formula used in Article 3(b) for the productivity factor used for permanent crops is 2.5 while annual crops is 1. The productivity factor for oil palm should be higher because oil palm is the most productive oil-bearing crop as compared with other annual oil crops. However, the productivity of the crops that are compared are not considered in the Commission Delegated Regulation. The acceptance of the various crops for being low ILUC risk without taking the yields into consideration will not help in combating deforestation as more land will be required to produce the same amount of oil to substitute a crop with a higher yield like oil palm. *Table 3* shows the various yields for selected oil crops.

Palm is 5.56 times more productive than rapeseed, 10.53 times more productive than soyabean and 7.84 times more productive than sunflower. If other vegetable oils that are categorised as low ILUC risk biofuel are required to substitute palm oil which is categorised as high risk biofuel, the consequence of this has to be considered as well.

TABLE 3. OIL YIELD OF SOME MAJOR OIL CROPS

Types of oil crops	Yield of oil (t ha^{-1} yr^{-1})
Oil palm	4.0
Rapeseed	0.72
Soyabean	0.38
Sunflower	0.51

Source: Yew *et al.* (2015).

If for example one million tonnes of palm oil needs to be replaced by any of the other vegetable oils there will be an increased demand for these other oils. Since the yields of these crops are significantly lower, there will be a need to increase the land cover to meet the demand. The land required to produce 1 million tonnes of oil for the various vegetable crops is as shown in *Table 4*.

TABLE 4. LAND REQUIRED BY SELECTED OIL CROPS TO PRODUCE ONE MILLION TONNES OF OIL

Oil crops	ha
Palm	250 000
Soyabean	2 632 500
Rapeseed	1 390 000
Sunflower	1 960 000

In other words, if soyabean oil were to substitute 1 million tonnes of palm oil, then it will need an incremental land of 2.63 million hectares to produce that same amount of oil that could have been obtained from palm oil in 250 000 ha. The same goes to rapeseed oil and sunflower oil which will require 1.39 million hectares and 1.96 million hectares respectively to substitute 1 million tonnes of palm oil. This consequence has not been addressed and may actually lead to higher land conversions which increases the amount of GHG emissions arising from the use of the so called low ILUC risk biofuels.

If the true intention of countries like the EU and the USA to include ILUC is for sustainability then it should be implemented across all sectors and not just on a minor sector like the biofuels from oil crops which is an insignificant contribution in the total GHG emissions of these countries or even the world. This is because out of the total global land area of 13.2 billion hectares, only 12% or 1.6 billion hectares are agriculture land (FAO, 2015). Out of this, about 17.3 million hectares are planted with oil palm (Yew *et al.*, 2015) as shown in *Figure 1*.

The land area cultivated with oil palm only accounts for 1.1% of the total global agriculture land. This share becomes even smaller when seen globally which only occupies 0.13%. Compared with other sectors like the livestock, which occupies 26% of the global ice-free land and another 33% of the land is used to cultivate crops to feed the livestock (FAO, 2012). In view of this, imposing ILUC or even banning such a feedstock will not help in combating deforestation.

Certification

Regarding the low ILUC risk certification, most stakeholders underlined the need to ensure transparency and avoid fraud through the certification system. The concern is that if only one international certification scheme like ISCC

is recognised then this will again be difficult both in procedural and also cost. A study by Higgins and Richards (2018) discussed that alternative sustainability standards schemes which are initiated through multi-stakeholders will be more effective instead of just an international scheme which were found to be depoliticising and marginalising. The study showed that these local multi-stakeholders' certifications like the Indonesian and Malaysian Sustainable Palm Oil standards (ISPO and MSPO) were not given enough attention and recognition both globally and in literature. The study found that schemes like the ISPO or MSPO are crucial as it creates an alternative farming frame for smallholders who may not be equipped to participate in international schemes like ISCC both technically and financially (Higgins and Richards, 2018). EU is urged to be more receptive towards the various local and international sustainability certification schemes. EU should address the gaps and help these schemes to be recognised as well.

RECOMMENDATIONS

Feedstocks should be evaluated by region to determine if it has high or low ILIUC risk instead of just categorising globally. If a feedstock from a certain region has no possibility to expand into high carbon stock areas it should be categorised as low ILUC risk as compared to its counterpart at different regions. This will not unfairly penalise sustainable producers of a feedstock.

The consequences of replacing high yielding feedstocks like palm oil with lower yielding feedstocks has to be considered before it is categorised as low ILUC risk as it can cause detrimental GHG emissions due to the need to clear more land to substitute the same amount of oil.

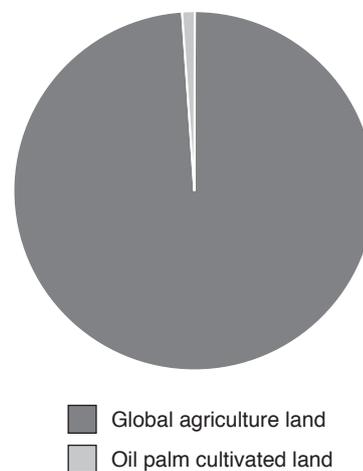The evaluation of renewable energy sources should be based on more robust data and information

Figure 1. Share of oil palm cultivated land in the global agriculture land area.

Global agriculture land
Oil palm cultivated land

instead of just relying on historical data. New government interventions and policies need to be considered. Evaluation of high and low ILUC risk should not be based on projections but rather with a more scientific methodology like the LCA.

ILUC implementation globally seems to be more politically driven rather than scientific and this should be transparently admitted.

CONCLUSION

The EU claiming to be combating deforestation by imposing ILUC on a minor user of global commodities is merely poor policy-making and, in this case, may also be threatening the GHG emissions reduction targets set against climate change. ILUC is a global phenomenon which is the sum of land use changes caused by several factors. Among the main contributors to the ILUC are agriculture, urbanisation, population growth, industrial activities, livestock, and poverty. Especially in developing countries, poverty is a major cause of deforestation. Due to multiple drivers for ILUC, the most effective way to mitigate ILUC is to control direct land use of the major users. This cannot be only implemented on the national country or continent level but needs to be handled through international systems. It is not reasonable to assume that ILUC could be controlled by imposing restrictions on one industrial sector. Addressing land use change and ILUC by one sector, *i.e.* biofuels will lead to leakage into other sectors and this will not have the desired outcome of reducing deforestation.

If palm oil is eliminated, more land is required to replace that same amount of oil which ultimately will increase the land use change and ILUC. ILUC seems to also have more of a political influence and trade protectionism rather than science.

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