JOINT SCIENCE AND ENVIRONMENTAL STAKEHOLDER COMMENTS ON:

Docket No. EPA–HQ–OAR–2011–0542: EPA's analyses of palm oil used as a feedstock under the Renewable Fuel Standard (RFS) program.

Environmental Protection Agency

April 27, 2012

National Wildlife Federation
Natural Resources Defense Council
Clean Air Task Force
Union of Concerned Scientists
World Wildlife Fund

Contents

As national science and environmental organizations we are pleased to provide comments on Environmental Protection Agency Docket No. EPA–HQ–OAR–2011–0542 "Notice of Data Availability Concerning Renewable Fuels Produced From Palm Oil Under the RFS Program". Representing millions of members and activists, our groups share a focus on fighting global warming, protecting human health, preserving natural habitat, and advocating for clean energy. That is why we believe it is vital for EPA's palm oil evaluation to adequately protect human health and the environment. We thank EPA for the opportunity to comment on this important analysis and hope that our remarks provide useful guidance for EPA's final decision.

1 Summary

The U.S. EPA has done a great deal over the last few years to advance the science of full lifecycle analysis for biofuels, and the latest analysis on palm oil continues this important progress. We commend the EPA for groundbreaking analysis on one of the most important areas of biofuels lifecycle analysis. We agree with the EPA, that palm oil does not meet the criteria for consideration as a renewable fuel under the Renewable Fuel Standard. Furthermore, as EPA acknowledges in the preface, its conclusions likely underestimate emissions, as they rely on midpoint estimates that in several important areas likely underestimate emissions.

In the paragraphs below we have summarized several specific areas in which the EPA's estimates of the emissions from palm oil based biofuels are too low, with more thorough analysis following in subsequent sections. We expect that a more accurate analysis will demonstrate that emissions from palm oil based diesel biofuels as produced today and in the foreseeable future are higher than fossil fuels. However, while our conclusion is that palm oil expansion is currently causing substantial emissions from land use change, there are important changes that the palm oil and biofuel industries and the governments of Indonesia and Malaysia (and other nations that are expanding production) can make to address many of these problems. We thus support the EPA in their proposal to leave open the potential for alternative pathway development to recognize improvements as they occur.

1.1 EPA underestimates the magnitude of expansion onto peat soils.

The EPA analysis concludes that 13% of the incremental expansion in Indonesia and 9% in Malaysia will occur on peat soils. This analysis is far out of line with recent studies of the matter and recent trends. The recent analysis of Miettinen et al. (Miettinen et al. 2012A and Miettinen et al. 2012B) suggests that based on recent trends modeling an overall fraction of expansion on peat of 32% is more appropriate, and that given the consistent acceleration of development on peat in the past two decades, this might be seen as a lower bound - they suggest that modelers should consider assessing a range for the value from 32% to 45%. This is consistent with analysis by the European Commission's Joint Research Centre (Edwards et al. 2010), which recommends that models use a fraction of expansion on peat of not less than 33%. This single correction alone will likely result in emissions from palm oil-based biofuels that are higher than from fossil diesel.

1.2 The Winrock GEOMOD model fails to capture key drivers of expansion onto peat soils.

The Winrock GEOMOD model does not take into consideration some key economic, socio-political and legal factors and as a consequence understates the likely expansion of palm oil plantations onto peat land. For example, the model does not consider the economic value of timber, the availability of large land areas on peat without disputed title and the stated land development plans of Government ministries, all of which are key drivers of the recent acceleration of palm oil plantation expansion on peat soils, particularly in Sarawak. Further, several of the physical factors which are considered, such as the location of roads and other palm oil facilities, are subject to change during the time-period of the projection. As a consequence, the model as currently constructed is of limited value in projecting the location of future development. In particular the model's projections are directly contradicted by recent history without offering a clear and compelling reason to expect such a sudden shift. Furthermore, recent scholarship calls into question the ability of the GEOMOD approach to make projections in complex landscapes that are more accurate than simpler approaches based on historical trends. In light of these problems, EPA should not use the GEOMOD approach as the basis for a regulatory determination.

1.3 Competition with food consumption

The FAPRI economic results suggest that fully 42% of the palm oil used for biodiesel comes from reduced human food consumption, which substantially lowers the emissions attributed to the biodiesel. Palm oil is a staple food source, especially in India and China, and a relatively inexpensive source of fat and cooking oil. The extent of substitution by higher priced oils or food sources like meat and dairy bears careful scrutiny as both a technical and a moral issue. The impact of reduced food consumption will fall disproportionately on poorer consumers, especially in India. We recommend that EPA examine the impact of expanded palm oil use for biodiesel on human diet and nutrition.

1.4 Expansion of other oil consumption causing palm oil expansion

The implications of the analysis in the current NODA go beyond the question of whether palm oil should qualify as a renewable fuel under the RFS. Because palm oil is the fastest growing and least expensive vegetable oil, future expansion of the biodiesel mandate will tend to expand demand for palm oil, regardless of whether the biodiesel is directly produced from soybean oil, rapeseed oil or chicken fat. EPA should conduct further work to assess the level of substitutability and fungibility in the global vegetable oil market, and if this supports a conclusion that the existing analyses have underestimated the effect of demand for other biodiesels on palm oil markets, the analysis of biodiesel from soy, canola etc. should be updated with a more complete inclusion of palm oil land use effects.

1.5 Modeling the world in 2022 rather than today

The EPA's decision to base the administration of the RFS on forecasts of predicted impacts in 2022 creates legal, technical and economic problems. Legally EPA was charged by Congress with ensuring that biofuels reduce GHG emissions over their lifecycle, rather than only after 2022. Technically, it is impossible to make accurate predictions about economic and social systems a decade in advance, as they are subject to structural changes that cannot be accurately predicted. And economically, judging a product based on presumptions of how it will be produced ten years in the future reduces the incentive for current producers to change their behavior now. EPA must base its evaluations on current data to minimize the impact of speculative model assumptions on the regulation and to encourage improved environmental performance.

1.6 Compounding effect of uncertainty

The EPA's substantial attention to uncertainty analysis is laudable, but the actual analysis is lacking in several key regards. A more complete uncertainty analysis would need to include the uncertainties in the economic analysis, the land use change, and the extent of peatland conversion. EPA has acknowledged that several of these factors have a significant probability of being underestimates. If this asymmetric uncertainty was included into a more complete uncertainty analysis, the most probable outcome would shift to higher emissions. EPA should conduct a more complete uncertainty analysis and adopt results based on the most probable values.

1.7 EPA must use conservative assumptions.

Palm oil derived biofuels pose serious environmental risks that are demonstrated by an established tendency towards deforestation of some of the world's richest carbon sinks. There is little empirical evidence to suggest a reversal of these trends anytime soon. Indeed, political and market forces described in section 2 below suggest that expansion into peatlands is likely to continue. The consequences of peatland clearing are well known. Indonesia represents the world's 17^{th} largest gross domestic product (International Monetary Fund, 2011), yet, it is the world's third largest emitter of greenhouse gas emissions (Sari et al., 2007), largely due to deforestation of carbon rich landscapes. The likelihood and consequences of deforestation require EPA to adopt a conservative approach that avoids substantial unintended consequences.

In projecting the state of oil palm expansion ten years in the future, EPA would have to assess claims by industry and government bodies about coming improvements in yield, governance, land development policies and enforcement and palm oil mill operations. Given the significant risks of palm oil expansion and a history of deforestation, EPA should reject optimistic claims and projections that are unsupported by conclusive evidence. We are aware of several initiatives, by governments as well as private voluntary certification efforts such as the Roundtable on Sustainable Palm Oil that show a degree of willingness to move in a positive direction. However, nothing currently in force is adequate to substantially mitigate the problems with current practice, in terms of loss of biological diversity, emissions from land use change and other impacts from palm oil expansion. Therefore these preliminary efforts do not change the clear evidence that oil palm expansion is having and will continue to have substantial negative environmental impacts. Making conservative assumptions will preserve the incentive for the governments, producers, and mills to make good on their commitments, which can be recognized by EPA in the future using the alternative pathway approach. If EPA builds its baseline analysis on non-binding promises, it will perversely make these outcomes less likely to be realized.

1.8 EPA uses erroneous inputs in its lifecycle analysis.

EPA uses several erroneous inputs in its lifecycle analysis. Correcting these inputs significantly reduces the emissions benefits of palm oil based fuels relative to conventional diesel. We describe several of these errors below.

- **Fossil carbon in Palm methyl ester (PME):** Palm methyl ester (biodiesel) produced using fossil-based methanol contains fossil carbon from the methanol in the final fuel, the combustion of which must be counted toward the fuel life cycle. Evaluated independently, including fossil carbon from methanol would reduce EPA's estimate of the emissions benefits for PME from 17% to 12%.

- **Chinese nitrogenous fertilizer**: China is an important and growing exporter of nitrogenous fertilizer, most of which is produced from coal rather than from natural gas as is generally assumed. Approximately 35% of nitrogenous fertilizer used in Indonesia and Malaysia is imported from China. Evaluated independently, properly attributing nitrogenous fertilizer to China would reduce EPA's estimated emissions benefits for PME and renewable diesel from 17% and 11% to 16% and 10% respectively.

- **Lower co-product credit:** EPA assumes that each MJ of glycerin and naphtha co-produced with PME and RD, respectively, displaces an equal energetic quantity of residual oil (for glycerin) and gasoline (for naphtha) without price effects. Analysis should allow for a rebound effect in fuel markets. Evaluated independently, setting the displacement factor to a value of 75% lowers EPA's estimated emissions benefits for PME and renewable diesel from 17% and 11% to 15% and 10% respectively.

- **2007 Global Warming Potential (GWP) values:** EPA uses outdated 1995 GWP values from the IPCC's Second Assessment Report. The most current values are from the 2007 Fourth Assessment Report (AR4). The GWP for methane has increased with each IPCC report, and is anticipated to increase again in AR5, so it's important to update these factors, especially for an analysis focused on 2022. Evaluated independently, using the IPCC's 2007 GWP values would reduce EPA's estimated emissions benefits for PME and renewable diesel from 17% and 11% to 12% and 6%, respectively.

These corrections alone would greatly reduce EPA's estimated emissions benefits for palm oil derived biofuel. Yet even these corrections do not reflect the larger errors in EPA's analysis. For instance, corrections to EPA's land use modeling will result in significantly more greenhouse gas emissions than EPA's findings anticipate. Those issues are discussed throughout the balance of this document.

2 Land use change

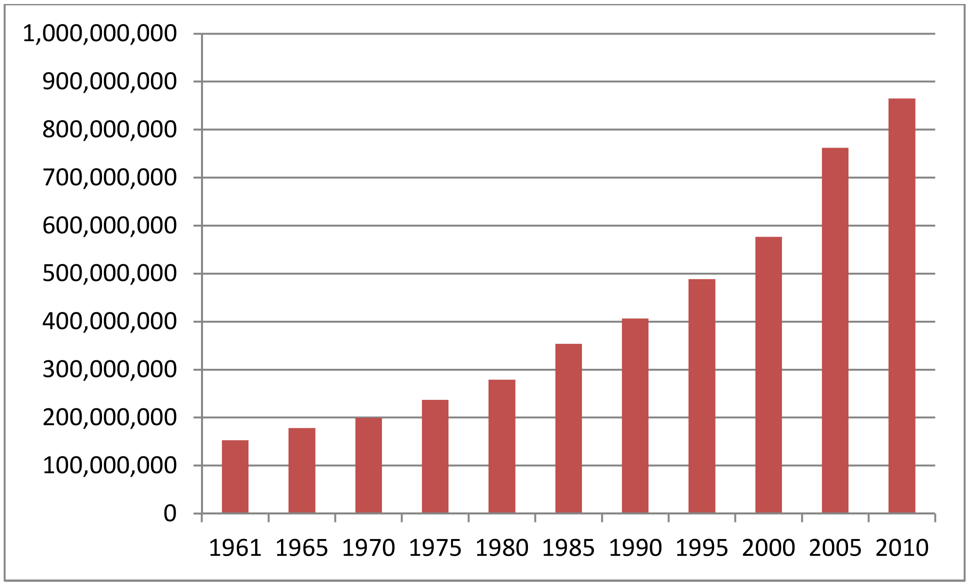
EPA estimates total land use change using the FAPRI model. This model predicts the amount of additional cropland required for oil palm in Indonesia and Malaysia, which are inputs to Winrock's more detailed analyses of LUC within these two countries.

2.1 EPA's FAPRI Analysis underestimates the potential of substitution, additional palm oil expansion, and trade policy.

The economic model (FAPRI-CARD) is used to determine the impact of palm oil biodiesel production on production and consumption of palm oil and other edible oils. The results of the model indicate that the palm oil production diverted to biofuel production is made up by a significant drop in food consumption (42% of extra demand) in response to higher prices. The extent of this lost production is problematic on both technical and moral grounds. While it is reasonable to expect some shift in consumption patterns when prices change, this large loss of an important staple food seems unlikely and warrants closer evaluation. Moreover, the impact of this lost consumption on poor food consumers bears further examination.

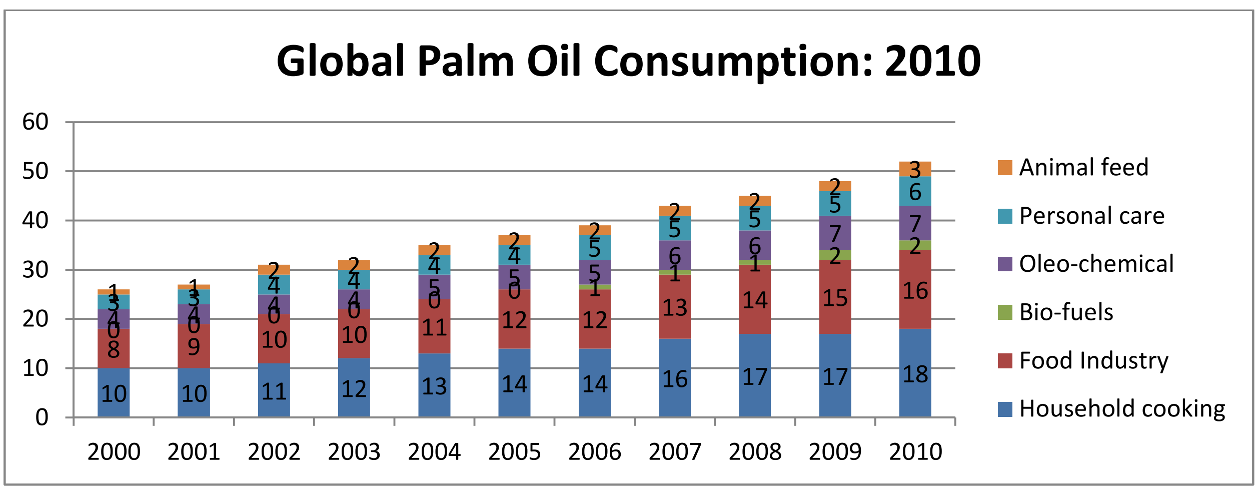
Developing countries are the largest importers of vegetable oil and in general these markets are heavily reliant on imports as their domestic production is unable to meet domestic demand. Specifically, India and China are the largest importers of vegetable oil (and the first and second largest importers of palm oil), supplying 50% and 32% of their domestic vegetable oil demand through imports respectively. With palm oil diverted to biodiesel production, less will be available for food consumption resulting in price increases and diversion from palm oil towards other vegetable oils to meet domestic demand. We believe that there are sound reasons to expect the relationship between consumption of vegetable oils an prices to rather less elastic than is currently modeled by FAPRI, and hence for consumption of palm oil be maintained rather than reduced.

Baseline agricultural forecasts, -- based on historic data compounded with a rising population and growing middle class, particularly in Asia -- already call for rapidly expanding demand for food uses of palm and other vegetable oils, which is stretching the capacity of the producers to keep up. The palm oil industry has been undergoing massive expansion, as global demand for edible oils has grown enormously, driven primarily by economic growth and prosperity in Asian markets. FAOSTAT data reflects a 5.6 fold increase of overall oilseed production from 1961 to 2010:



Production in tonnes of Total Oilseeds from 1961 to 2010
Data Source: FAOSTAT

India, China and other Asian countries represent a major portion of current palm oil consumption as this region has experienced rapid economic growth. In spite of the global recession and historically high prices for palm oil, global consumption of palm oil has increased 20 percent in the last 4 years, and two thirds of this growth has been in Asian countries (see Appendix 1). Biofuels, as seen in the chart below, have not played a significant role in palm oil consumption, and currently represent roughly 2 million tons per year. In fact, 70% of demand for palm oil is food related.



Palm oil consumption in millions of tons per year. Source: Boston Consulting Group

In spite of the rapid expansion, global palm oil production has barely kept pace with consumption. Expanding biofuels usage would certainly require expansion of production area, and the emissions associated with the land use change resulting from this incremental production must be considered.

Palm oil, rapeseed oil and soybean oil are all substitutes for each other for many uses, with palm oil being the least cost alternative. Palm oil is now and is expected to be the marginal vegetable oil in 2020 due to lower price of palm oil relative to other oils (Schmidt and Weidema, 2008). EPA estimates that of the additional vegetable oil produced in the biofuel scenario, two thirds will be palm oil, and one third will be from soybean, rapeseed and other vegetable oils.

Soybean oil is the second largest imported oil after palm oil and commands a premium over palm oil. With a price driven drop in palm oil consumption, a shift towards other vegetable oils is expected. While EPA accounts for the indirect land use change impacts associated with the increase in production of soy, rapeseed and other vegetable oils, it does not explain where they expect those increases to occur. Soy is potentially the critical oilseed to consider, as the associated GHG emissions may differ depending on whether the resulting soy expansion is projected to occur primarily in the United States or in Brazil. We would expect that expansion is more likely to occur in Brazil because of lower cost production. If, however, the analysis projects increased expansion primarily in the United States, then it likely underestimates the GHG emissions associated with clearing in the Brazilian Cerrado and elsewhere.

We note that soybean oil is a dependent co-product rather than a deterministic co-product, i.e. we expect soy area to be driven strongly by soy meal demand, and only weakly by vegetable oil demand. This means that if there is no demand for additional meal by the livestock industry, the likelihood of soybean expansion will be limited. Given this, we suspect that the cross-price elasticity of substitution between soy and palm may in fact have been overestimated. That is, we might expect substitution effects to be rather more limited than FAPRI currently models (with only two thirds of additional oil coming from palm and one third from other crops).

Additionally, palm oil consuming nations have tools to minimize elevated food costs due to palm oil diversion. Trade policies play a major role in the domestic price of the commodity being imported and its subsequent demand. Thus a reduction in import duty on palm oil would lower the domestic price of the palm oil and would increase demand even if there is an increase in world price. For example, palm oil imports in India have a high import duty. India recently reduced its import duty on palm oil, which increased palm oil imports by 300%. It is foreseeable that governments with these and similar options would rather adjust trade policy than allow spiking food costs to drive discontent within their borders.

All of this is to say that the own-price elasticity of demand for palm oil, and the unmet demand for palm oil it implies, has a very large impact on the results of the EPA analysis. The unmet demand for vegetable oil should be subject to a thorough discussion, considering both existing econometric data, and an analysis of whether the data is adequate. In addition, a higher level discussion is needed about whether it is appropriate to count unmet demand for human consumption of a staple food crop toward reducing the net GHG emissions of a biofuel. We expect that the preamble to the final rule will include EPA's approach to this important issue.

2.2 Change analysis (Winrock reports)

The purpose of Winrock's analysis is to predict locations of future palm oil expansion until the year 2022. The model takes as input the additional production area in oil palm estimated by the FAPRI model to occur in Indonesia and Malaysia and projects where specifically, and on what type of soil (peatland or mineral), this expansion will occur.

2.2.1 GEOMOD results contradict recent trends in palm expansion.

The most obvious problem with the GEOMOD results is that its projections are entirely inconsistent with recent trends. According to the Malaysian Palm Oil Board's published work, between 2003 and 2009, the fraction of palm oil plantations on peat increased from 8.2% to 13.3%. Accounting for the rate of palm oil expansion in this period suggests that 29.6% of new Malaysian oil-palm plantations were on peat (Omar 2010). In fact, this trend is accelerating, and has been documented by researchers (Miettinen et al. 2012A, Sarvision 2011, Wetlands International 2010). A direct examination of recent trends suggests that palm oil expansion over the next decade is likely to occur on peat at least one third of the time, and possibly more (Edwards 2010, Miettinen et al. 2012A). There was no adequate explanation of the divergence between the model projections and the current trends, so the only conclusion we can reach is that the model is not able to adequately project land use change. According to the Winrock report, the GEOMOD assessment has been compared to data on palm oil area changes from 2001 to 2009 based on mapping, and gives a 'good' result for statistical correlation. Given the clear shortcomings of GEOMOD in matching the trend as regards expansion on peat over that period, we conclude that either a) GEOMOD has a strong record of predicting areas of palm oil expansion with the *specific exception* of being very poor at predicting expansion on peat; or b) the mapping data used to validate GEOMOD is of poor quality, so that GEOMOD results correlate well with a set of data on historical changes *that is largely factually incorrect*. In either case, given that the expansion on peat is the most important question for this model because of its carbon implications, we believe it is clear that in its current incarnation it is not appropriate to use GEOMOD results in a regulatory finding.

2.2.2 GEOMOD modeling relies on poor quality satellite data,uses unreliable suitability factors and ignores known drivers of peatland development.

Winrock used the GEOMOD model to project where palm oil expansion would occur. GEOMOD considers a set of biogeophysical factors and a set of training data (maps at two points in time) to calibrate and validate the model so that a weighted (or unweighted) combination of these factors predicts the changes between the two training maps. The resulting weighted factors are then applied to the present conditions to predict the most likely locations for future expansion. For this analysis, fourteen factor maps were created, representing elevation, precipitation, temperature, slope, soil type, land cover type in 2001, distance to roads, distance to rivers, distance to railroads, distance to settlements, distance to palm mills, peat soil location, land allocation, and distance to existing plantations.

There are several problems with this approach: (i) the maps of oil palm plantations used to train the model are (according to Winrock) of questionable quality, (ii) the GEOMOD analysis is based entirely on physical criteria and omits important economic drivers such as the presence of merchantable timber, and (iii) it assumes structural (physical and policy) constancy. Nearly half of the suitability factors are distances to infrastructure as they existed in 2001, which (other than rivers) could change in the intervening 21 years, including roads, railroads, settlements, palm mills, and existing plantations.

Winrock projects that 88% of the oil palm expansion in Indonesia will take place on the island of Sumatra (Riau, 29% of the total; Sumatera Selatan, 18%; Sumatera Utara, 16%; Jambi, 10%). In Malaysia, Winrock projects that over 70% of oil palm expansion will occur in 4 provinces: Johor (23%), Pahang (20%), Sabah (16%), and Perak (12%). However, 91% of the total expansion of oil palm on peatlands is projected to occur in Johor (47% of the total), Sarawak (21%), Perak (14%), and Selangor (10%). In total, EPA estimates about 11% of total oil palm expansion in these two countries will occur on peatlands.

GEOMOD requires that the values be stratified into “bins” so that categorical values of suitability can be created. Winrock does not seem to consider the possible effect of alternative bin definitions on the projected land conversion, although this could clearly influence the results.

Winrock recognizes substantial uncertainty in their projections, resulting from the questionable input data for oil palm locations and land cover categories and the low persistence of plantations between 2001 and 2009. They write:

> The result was that the areas modeled as suitable for transition were not always the same areas that were converted by 2009, which affected the validation of the model by increasing disagreement due to location. Using a static land cover map from 2001 to project land cover impacts in 2022 also introduces uncertainty because land cover is a dynamic spatial feature.

Roughly 866,000 ha classified as oil palm in 2003 were not classified as oil palm in 2009. Whether this indicates “a dynamic landscape" or is simply a classification error in the data is unknown. According to Winrock, assuming that no oil palm areas were actually retired in this period gives a total increase in oil palm area of 59% from 2003. However to be “conservative”, Winrock assumes that the lower numbers represented an actual net increase of 37%. Moreover, Winrock assumed that oil palm could not expand into areas designated as oil palm plantations in 2003 even if those areas were considered not to be oil palm plantations in 2009. More careful scrutiny of the 2003 to 2009 discrepancy and cross checking against other data sources is needed to accurately determine the extent of palm oil expansion between 2003 and 2009. At very least, it would be instructive in a future uncertainty analysis to examine this alternative scenario in GEOMOD to understand the effect on total greenhouse gas emissions from the two biofuels under consideration.

Peat swamp forests occur when partially decayed matter are accumulated in standing water and its decay is inhibited due to the lack of oxygen and high acidic levels. Tropical peat swamps occur in the South East Asia region, with the largest areas and deepest peat being found in Sumatra and Borneo. Most relevant to the EPA analysis are the carbon sequestration figures for intact peat lands and the GHG emissions resulting from their conversion to other uses, including palm oil cultivation.

It is instructive to compare the areas of expansion projected by Winrock with current industry trends. The analysis includes a projection of where the palm oil expansion is expected to take place in both Indonesia and Malaysia. In the case of Indonesia, the modeling analysis concludes that Kalimantan would be the most likely target, and the actual trend of the industry has been to expand in this region. In the case of Malaysia, the study concludes that while Sarawak has the most development potential, most of the expansion would occur in Peninsular Malaysia around existing infrastructure. The study notes that development in Sarawak would be complicated due to peat forests and land rights issues. Recent data showing where the industry is actually installing processing capacity points to a somewhat different conclusion:

Number of Extraction Mills (MPBO)					
Location	**2008**	**2009**	**2010**	**2011**	**2012**
Peninsular	249	245	247	246	245
Sabah	117	118	121	124	124
Sarawak	41	47	50	53	53

	Malaysian Palm Oil Industry				
	Hectares in Production				
	2007	**2008**	**2009**	**2010**	**2011**
Peninsular	2,537,354	2,631,075	2,621,882	2,660,538	2,687,259
Sabah	1,137,318	1,183,594	1,205,685	1,236,278	1,262,023
Sarawak	495,533	546,737	615,673	703,097	781,314
Total	4,170,205	4,361,406	4,443,239	4,599,913	4,730,596
	% Change				
Peninsular		3.7%	-0.3%	1.5%	1.0%
Sabah		4.1%	1.9%	2.5%	2.1%
Sarawak		10.3%	12.6%	14.2%	11.1%
Total		4.6%	1.9%	3.5%	2.8%
Source: MPOB Website					

So while the Winrock study correctly identifies issues in Sarawak around development on peat and issues with land rights, these concerns appear not to affect where the industry is actually installing capacity. Just in the last 4 years, the number of mills installed and operating in Sarawak has increased significantly while the number of mills in Peninsular Malaysia declined during the same period.

In terms of acreage expansion, it is clear that Sarawak is also driving the palm oil expansion. In the last 5 years, the industry expanded 560,000 hectares, and more than half of these were in Sarawak. The government has actively been pursuing the development of palm oil on peat soils. (http://biz.thestar.com.my/news/story.asp?file=/2007/4/18/business/20070418151554&sec=business)

ANNUAL DEFORESTATION OF PEATLAND SARAWAK

YEAR	FOREST AREA (HA)	FOREST AREA CHANGE (HA)	PERCENT
2005	1,055,896.7	No data	No data
2006	990,437.6	-65,459.1	-6 .20%
2007	924,978.5	-65,459.1	-6 .61%
2008	847,256.4	-77,722.1	-8 .40%
2009	769,534.3	-77,722.1	-9 .17%
2010	702,966.7	-66,567.5	-8 .65%

Source: Impact of oil palm plantations on peatland conversion in Sarawak 2005-2010, Sarvision, 2011.

KUALA LUMPUR, Feb 4 — Sarawak's rapid expansion of oil palm plantations may result in its unique peat forests being wiped out by the end of the decade, says environmental watchdog Wetlands International.

The Netherlands-based group claimed Sarawak had destroyed nearly 800,000 hectares or 10 per cent of its entire forest in the past five years, nearly four times faster than the rest of Asia which lost 2.8 per cent of its forests in the same period. FEB 4, 2011

http://www.themalaysianinsider.com/malaysia/article/palm-oil-risks-all-sarawak-peat-forests-by-2020-says-study/

The new report from Sarvision (2011), also documents that in fact deforestation in Sarawak has been increasing in recent years, and that a large fraction of it is due to oil palm. Their detailed GIS analysis found that "In the period 2005-2007 1.89% of the total forest cover was cleared, while in the period 2009-2010 this increased to 2.14%." Furthermore, "deforestation of peatland in Sarawak is occurring at much faster speeds compared to deforestation of all forest cover: on average 8% of the peat swamp forest area has been cleared annually, compared to 2% on average for all forest in Sarawak." Their analysis ties this deforestation to oil palm; indeed by overlaying palm oil concession boundaries on areas of deforestation in Sarawak, they showed the "of the deforestation on peat during 2005-2010, at least 65% could be attributed to the establishment of oil palm plantations." They also point out that, because of incomplete data on palm oil concessions, this is actually a conservative figure.

The palm oil industry in Malaysia faces several challenges, including land scarcity, labor scarcity and rising production costs. However, the Malaysian government's New Economic Model for Malaysia (NEM) identifies the palm oil sector as an important driver for economic development – in 2008, the sector contributed 3.2% of real GDP – and makes recommendations for improvement, including increasing the use of land for oil palm. In Peninsular Malaysia and Sabah, oil palm expansion faces severe limitations due to land scarcity, given competition with increasing urban development. In contrast, Sarawak has in place plans to increase oil palm plantation areas from the initial target of 1 million ha to 2 million ha by 2020. In 2010, total plantation area was about 919,418 ha.

An additional limitation of the GEOMOD approach relates to the issue discussed earlier of making predictions in the face of structural change. The "distance from roads" metric shows decreases in the five lowest distance bins and increases in all the higher distance (> 5 km) bins, indicating that more remote land is being used. This seems irrational, but a simple explanation would be that new roads have been added. If, in fact, distance to roads is an important predictor, the model is severely limited by its lack of knowledge of where roads will exist in 2022.

The GEOMOD approach leaves out economic and political drivers that have been shown by recent research to be critical to oil palm expansion, and that tend to lead to preferential expansion into forested and peatland areas. Fisher et al. (2011), using a very large, long-term data set from Sarawak, showed that the Net Present Value of timber is about equal to that of oil palm production, and that both are very high – on the order of $ 10,000/ha. In response to a letter alleging that their values were unrepresentative (Ruslandi et al. 2011), the same authors did a survey of the literature and found that, although NPV show substantial variation, the value of timber is actually considerable high in some cases and their original figure is a reasonable mid-range estimate (Edwards et al. 2011).

This combination of high-value produces a strong incentive to expand palm oil production into forested areas, so as to capture the value of the timber as well as that of oil palm production. This economic incentive is not taken into account by the GEOMOD approach.

An additional incentive to expanding palm oil plantations into forest is the ability to gain control of larger contiguous blocks of land, reducing potential conflicts and social problems with adjacent landowners. Gutierrez-Velez et al. (2011), examining the expansion of oil palm in the Peruvian Amazon, found that expansion, and particularly the expansion of high-yield plantations, showed a strong preference for forested areas for this reason, so that 72% of new plantations were in forested area. It should be noted that this sociopolitical reason for preferring forest for new expansion is separate from, and additional to, the economic reason demonstrated by Fisher et al., since the timber values in Peru are much lower than on Sarawak and also compared to southeast Asia in general. Thus in Malaysia and Indonesia, both economic and sociopolitical logic favors expansion into forest, and thus into forested regions such as Sarawak rather than more-cleared ones such as peninsular Malaysia and Sabah.

The work of Fisher et al., Edwards et al., Gutierrez-Velez et al. and Sarvision, and the empirical evidence that the industry is actually expanding in Sarawak, demonstrate that economic and sociopolitical drivers create a preference for expansion into forest and onto peat, and that this preference is manifested in increasing deforestation, especially on peatland. This evidence suggests that Sarawak will play a key role in any future expansion of Malaysian palm oil sector.

These trends should compel EPA to adopt a more cautious and exhaustive approach than it is considering under the proposed rule. Clearing forests and peatlands for palm oil production is extraordinarily carbon intensive and these very recent findings demonstrate the high risk of unintended consequences. The literature and trend data cited above indicate that EPA's finding that only 7% of Malaysian oil palm expansion will occur in Sarawak is dangerously low.

The validity of any projection depends on whether the driving economic, political, agricultural, and environmental forces and constraints that produced the historical pattern remain constant in the future. If this is not the case, any prediction may prove to be wildly incorrect. Indeed the trends identified by the GEOMOD model are contradicted by recent history, which suggests GEOMOD does not yet have sufficient predictive power to accurately capture even major trends. Given these deficiencies, it is certainly not suitable to serve as the basis of the palm oil determination at this time. EPA may wish to continue to develop the GEOMOD modeling approach, in particular seeking to incorporate economic and legal suitability criteria that are clearly so important to the decisions of real-world decision-makers who will ultimately determine where palm oil expansion occurs. Bringing a model, thus revised, before an appropriate panel of experts and stake holders can enhance the analytical base of future EPA lifecycle determinations.

2.2.3 The technical capacity of Winrock's GEOMOD approach is not well established.

The Relative Operating Characteristic (ROC) statistic was used to evaluate whether the locations with the highest values in the suitability map were also the locations of actual change to palm oil between 2000 and 2009. In Malaysia, the weighted ROC score was 0.881, while the unweighted ROC was 0.879, barely different; however the unweighted ROC resulted in slightly higher Kappa statistics. The unweighted approach results in more conversion on peat (10% rather than 9%).

In choosing the best performing weighting of the ROC statistic Winrock's relied on a statistical (kappa) index that has recently been renounced by one of its creators in a paper titled "Death to Kappa" (Pontius and Millones 2011). Pontius and Millones write:

> This article reflects more than a decade of research on the Kappa indices of agreement. We have learned that the two simple measures of quantity disagreement and allocation disagreement are much more useful to summarize a cross-tabulation matrix than the various Kappa indices for the applications that we have seen. We know of no cases in remote sensing where the Kappa indices offer useful information because the Kappa indices attempt to compare accuracy to a baseline of randomness, but randomness is not a reasonable alternative for map construction. Furthermore, some Kappa indices have fundamental conceptual flaws, such as being undefined even for simple cases, or having no useful interpretation. The first author apologizes for publishing some of the variations of Kappa in 2000, and asks that the professional community does not use them. Instead, we recommend that the profession adopt the two measures of quantity disagreement and allocation disagreement, which are much simpler and more helpful for the vast majority of applications.

It's not clear whether this recommendation against using Kappa indices would affect Winrock's choice of the best predictor of land use change. It is clear, however, that the weighted ROC results in greater peatland conversion in Malaysia. The analysis for Indonesia does not present the weighted ROC results, so the effect in that region is unknown.

Even more recently a detailed analysis by Sloan and Pelletier examines whether a similar approach can provide a reliable projection of forest cover change (they are specifically considering the use of these projections for baselines under REDD+, but the application is closely related to EPA's use). Their model is more sophisticated than the Winrock approach in that it includes socioeconomic drivers and driver interactions, and its projections are stratified by province and then assembled nationally. However, in spite of that, they still conclude that detailed GEOMOD approach does not provide reliable projections:

> We conclude that, with the exception of contexts where forest-cover change is significant and straightforward and where forest-carbon density relatively uniform (e.g., agricultural frontiers), spatially

> projected baselines are of limited value for REDD+ – their accuracy is too limited given their relative lack of transparency. Simpler, relatively coarse scale, retrospective baselines are recommended instead.

This conclusion comes in spite of the fact that internal consistency checks suggest a high degree of accuracy.

> Although projection accuracy appears high, it is actually ~4% less accurate than the 'null model' that predicts no change over the commitment period, that is, that anticipates the 2008 landscape solely on the basis of the 2000 landscape. The null model has a disagreement of quantity and allocation of 4.3% and 7%, respectively. The inferiority of our projection relative to the null model is actually typical of spatial projections at their original- pixel resolution (e.g., Pontius et al., 2008). However, it is surprising that our projection remains inferior to the null model at increasingly coarse resolutions (Fig. 5). It would therefore appear that the forest-cover change is more complex that the rules and information by which our model projects forest-cover change.

This new analysis provides a strong argument for EPA to abandon the GEOMOD approach until such time as its validity and utility are better established.

2.2.4 Projected Harvested Area Data

In Table II-3 of EPA's analysis, the total areas in the control case for Projected Harvested areas does not seem correct for either Indonesia or Malaysia.

a. Indonesia: In 2010, the USDA reported 7.65 million hectares planted, and an annual planting rate of 300,000 hectares per year in Indonesia. (USDA FAS Commodity Intelligence Report, Indonesia: Rising Global Demand Fuels Palm Oil Expansion, October 8, 2010). EPA reports 6,179,000 hectares as the baseline.
b. Malaysia: in 2011, Malaysia reports 4,716,000 hectares in production. (MPOB website). EPA is reporting 5,201,000 hectares as the baseline.

3 EPA uses unreliable yield forecasts.

EPA relies on trends in palm oil harvested area and yield assumptions/projections from the FAPRI-CARD model, which assumes a greater than 15% increase in oil palm yield from 2008-2022 in Indonesia and Malaysia. EPA compares two yield forecasts, concluding:

> Since our analysis focuses on projecting impacts in 2022, the fact that both forecasts project the same average yields in Malaysia in 2022 (5.0 tCPO/ha) supports the robustness of our yield projections.

That two forecasts produce a similar estimate does not indicate robustness. Both could be wrong, for similar or different reasons. Because projected yields are so important to the results of the analysis, we recommend EPA consider the trends in Indonesia and Malaysia separately, and also take into consideration the yield differences between palm grown on peat and mineral soils.

The yield projection of 5 tons per hectare in 2022 (based on USDA data), is optimistic for a number of reasons. Currently, the yields in Indonesia and Malaysia are 3.8 tons/hectare and 4.0 tons/hectare respectively. The main driver for the recent trend upwards has been a shifting cultivation age due to the rapid expansion in plantings, while the replanting of overage areas has fallen behind, and these areas are declining in productivity. If replanting programs aren't initiated soon and maintained, sustaining the current upward trend will be difficult. This is currently a major issue confronting the industry, especially in Malaysia. While palm oil prices continue to be high, producers are very reluctant to replant areas due to the lost production in the early years of the new trees.

As the analysis highlights, replanting of palm oil cultivations is theoretically done 25 years after planting, and plantations are in their immature phase for 3 years prior to entering production. This would result in a steady state ratio between immature/mature palms of 12-15% if the original plantings were also sequenced and brought into production in a uniform fashion. This is rarely the case, and so there may be huge variability in the cultivation age distribution, caused by both the original plantings as well as delays in replanting. While cultivation age profile information is difficult to come by, in the case of Indonesia we have the following from FAS which clearly shows that the immature plantings have had a profound impact on land use change. This same data also skews the yield trend line, as a younger plantation age will have higher yields. As can be seen in the charts below, the age distribution of the cultivation base is highly skewed, and certainly not reflecting a "steady state" situation. This will have short term impacts on yields….but one must also remember, that in ten years (2022), this "bulge" will be in the 20-25 year bracket, will have declining yields, and also will require intensive replanting.

Source: Tree Crop Estate Statistics of Indonesia

Source: USDA Foreign Agricultural Service

The current USDA trend lines on yields are greatly influenced by the rapid expansion and a "juvenile" cultivation base. This bulge will age, and yields will decline naturally. While new planting materials certainly have great potential to increase yield, the current yield gap is primarily driven by poor nursery and land preparation practices, poor execution of basic agricultural practices such as harvesting and pruning, as well as inadequate nutritional programs. While the larger plantation companies are better able to execute these Better Management Practices, the smallholders face some very real hurdles in being able to overcome these yield barriers. (Donough et al. 2009)

While we would very much like to see yields improve, we believe that projecting 5.0 tons/hectare is unreasonable given that this would require systemic changes in management culture and technical assistance to the smallholders in the very near term. In terms of the current trends, smallholders represent a significant portion of the current expansion in Indonesia, and these farmers do not have ready access to technical assistance and inputs. In Indonesia, smallholder make up 40% of the area planted, and have significantly lower yields.

It should also be noted that average yield in 2022 will be greatly influenced by where palm oil expansion takes place. The analysis projects that there will be a reduction in utilization of peat soils. Peat soils have also historically had significantly lower yields than mineral soils, and this can clearly be seen in the case of Sarawak, where peat soils predominate. This is a significant factor as both yield and utilization of peat soils strongly influence estimates of emissions. In the case of Malaysia, recent trends discussed above suggest that a large share of incremental hectares have come from Sarawak, and vast majority of these hectares are peat. This would indicate that much of Malaysia's incremental hectares are from peat, with higher emissions and lower yields. The breakdown of peat acreage used for emissions should also factor into the calculation of yield potential.

4 EPA's uncertainty analysis excludes highly relevant factors.

As with the final RFS2 analysis, EPA has examined only a portion of the overall uncertainty in their analysis. Unfortunately, this provides little useful information, as the portions of the model excluded from the uncertainty analysis could easily contribute the majority of the variance in the result.

In the document titled "Consideration of Uncertainty Related to Lifecycle Greenhouse Gas (GHG) Emissions from Renewable Fuels Produced from Palm Oil", EPA writes:

> The uncertainty assessment for the RFS2 rule was updated for our palm oil analysis by incorporating the new estimates for palm oil carbon stocks, forest carbon stocks and peat soils. Although these data updates have been incorporated, our uncertainty assessment does not account for all of the improvements that were made in our analysis of Indonesia and Malaysia. For example, the uncertainty assessment does not consider our more detailed spatial modeling of Indonesia and Malaysia using the GEOMOD model. These changes were not incorporated because our Monte Carlo analysis was not designed to estimate uncertainty in results from the GEOMOD model. As such, the high- and low-end of the range of results for Indonesia and Malaysia are based on uncertainty in the land use change methodology used in the RFS2 rule. We believe this approach provides a reasonable estimate of the range of uncertainty in land use change GHG emissions in the scenarios analyzed.

EPA's spreadsheet shows a 95% confidence interval around total CO_2 emissions ranging from 1.39 million tonnes CO_2e to 3.31 million tonnes CO_2e, with a mean value of 2.31 million tonnes CO_2e. As indicated above, this doesn't include uncertainty in the emission factor for peat conversion or in the area projections of GEOMOD. In addition, the analysis excludes uncertainty in the economic model results. One error was detected in EPA's spreadsheet "Land use change GHG emissions factors.xlsx", in the calculation of uncertainty in the change in carbon stocks. The analytic propagation method was improperly applied, using the sum of the before and after carbon stocks in the denominator rather their difference, thus underestimating the uncertainty in carbon stock changes. This underestimate is presumably used in the subsequent analysis, though we failed to locate where and could not see the effect of the correction on the final frequency distributions.

EPA provided the 95% confidence interval values for land use change emissions, but these are copied into rather than computed in the spreadsheet. It was not possible to include uncertainties in the peat emission factor and in the total land use change emissions. Thus, the estimate of uncertainty (documented separately) is complementary to that estimated by EPA.

5 Life cycle assessment of palm oil biofuels

As with the final RFS2 analysis, the palm oil analysis is a hybrid between attributional and consequential LCA. EPA uses attributional analysis for agricultural production of oil palm, milling, biorefining of crude palm oil and transportation of final biofuels, and consequential analysis for the effects of increased palm-based biofuels on agricultural and land markets.

EPA handles co-products using the displacement method, which identifies a substitute product believed to be avoided by the presence of the co-product. Unlike the consequential analysis of effects of increased biofuel production on agricultural and land markets, the displacement method admits no price effects in co-product markets, instead employing a commonly-used but naïve assumption of perfect substitution of a single product identified by the analyst. For example, EPA assumes that every MJ of glycerin co-produced with biodiesel avoids the emissions associated with producing 1 MJ of residual oil, and each MJ of naphtha co-produced with renewable diesel similarly replaces 1 MJ of gasoline, in both cases without price effects. Several recent studies of price effects in fuel markets suggest much lower replacement rates owing to rebound effects in the 30-70% range (Barker, Dagoumas et al. 2009; Hochman, Rajagopal et al. 2010; Stoft 2010; de Gorter and Drabik 2011; Rajagopal, Hochman et al. 2011; Thompson, Whistance et al. 2011).

Unnasch et al. note that the market for bio-glycerin has become saturated in Malaysia in recent years (Unnasch, Sanchez et al. 2011, p. 26), suggesting that EPA's co-product credit are likely to be too high.

Setting the co-product displacement benefits in these two fuel pathways to zero shows the relative importance of these assumptions: the emissions reduction for biodiesel drops from 17% to 11%; the reduction for renewable diesel drops from 11% to 8%. In all likelihood, the proper co-product credit is between 0% and 100% of the value assumed by EPA.

5.1 Agricultural production

Life cycle assessment studies cited by EPA note the lack of data on fuel use and nitrogen fertilization for oil palm production (Unnasch, Sanchez et al. 2011, p. 15 and 19). According to EPA, the Roundtable on Sustainable Palm Oil (RSPO) reports a fairly wide range of fertilization rates:

> For example, (RSPO 2009) finds a range of nitrogen application rates ranging from 88.2 to 100 kg N/ha/yr, phosphorous application rates in the range of 28-45 kg P_2O_5/ha/yr, and potassium applications rates

commonly between 172-252 kg K_2O/ha/yr. Based on MPOB survey data Unnasch et al. assumes 69.8 kg N/ha/yr, 56 kg P_2O_5/ha/yr and 230 kg K_2O/ha/yr.

We note that Unnasch's estimate for N and P_2O_5 are respectively below and above the ranges reported by RSPO.

5.1.1 EPA underestimates fertilizer emissions

According to the Fertilizer Industry Association of Malaysia, the country imports much of its ammonia sulfate (nitrogenous fertilizer). In 2008 its sources consisted of 35.5% China, 25% Japan, 14% Korea, 10% Taiwan, 2% Russia (Sabri 2009). According to the China National Chemical Information Center website[1] "[c]oal-based ammonia accounts for 79% of China's total ammonia output, and natural gas-based ammonia accounts for 20%" and "[m]ore than 90% of ammonia is used for fertilizer production in China." Chinese fertilizer is frequently produced in smaller, inefficient facilities (Zhou, Zhu et al. 2010). According to a life cycle assessment of fertilizers used on New Zealand farms, the best-available technology worldwide for ammonia production produces 1.57 Mg CO_2/Mg NH_3, whereas the average for coal-based production in China is triple that at 4.58 Mg CO_2/Mg NH_3 (Ledgard, Boyes et al. 2011).

A consequential analysis should consider the marginal source of fertilizer. If this is based on Chinese production, then higher emission factors are appropriate. We suggest adjusting EPA's model to assume that 70% of total additional N fertilizer use occurs in Indonesia and Malaysia, which use Chinese imports for 35% of the total, with emissions 2.9 times higher than the average assumed by EPA.

5.2 Palm oil mill

5.2.1 EPA uses unreliable methane capture data for palm oil mill effluent (POME)

EPA assumes that plants capturing POME methane (CH_4) capture 90% of the produced gas, based on CDM guidelines. EPA notes that the range on CDM project design documents is 87-95%, which does not capture the uncertainty of the individual estimates, and EPA notes the lack of field measurements for any of this. Moreover, CDM project documents are hardly an unbiased sample: since the purpose of a project is to sell emission reduction credits, the analyses are designed demonstrate the maximum plausible GHG reductions. EPA should not give any credit for methane capture without credible data based on field measurements rather than on design documents.

5.3 EPA uses outdated Global Warming Potential values.

EPA's assumptions surrounding the conversion of methane emissions to CO_2-equivalents turns out to be quite important. EPA uses Global Warming Potential (GWP) values from the IPCC's 1995 Second Assessment Report. This decision is an administrative rather than scientific decision, made for the purpose of maintaining consistency with EPA's national GHG inventories, though it's also unclear why the inventories continue to use outdated values.

The IPCC has updated its GWP values twice since 1995, in the Third (2001) and Fourth (2007) Assessment reports. EPA still uses 100-year GWP values of 21 for CH_4 and 310 for N_2O, while the most

[1] See http://www.fertmarket.com/newsabout.aspx?id=38

recent values published by the IPCC are 25 and 298, respectively (Forster, Ramaswamy et al. 2007). The N_2O value hasn't changed enough to affect the present analysis, but the CH_4 value has: adjusting the value used in EPA's analysis from 21 to 25 removes 5 percentage points from EPA's estimated reductions relative to fossil diesel. That is, the estimated GHG benefit over fossil diesel from PME declines to -12% from -17%, and from RD declines to -6% from -11%. Notably, the increase in the GWP of methane is expected to continue (Reisinger, Meinshausen et al. 2011), putting EPA's choice of 1995 values increasingly at odds with the most current science. (We note that using 2007 GWP values consistently across the life cycle analysis would slightly increase the carbon intensity of fossil diesel as well, but not nearly as much as it increases the values for PME and RD.)

The IPCC recommends 35% uncertainty (representing +/- 2 standard deviations) for its Global Warming Potential (GWP) values. Because of the quantity of methane released from POME treatment, the GWP for methane shows up as one of the greatest contributors to variance in uncertainty analysis, and emphasizes the importance of EPA's choice of GWP values.

5.4 Biorefining

5.4.1 Biodiesel (palm methyl ester, PME)

5.4.1.1 EPA overestimates the displacement value of co-produced glycerin.

Given marketplace realities, 100% displacement with glycerin co-product is unlikely. Modifying EPA's model to allow actual displacement to vary between 75% and 100% (implying that the remainder of the glycerin is additional to what would have been consumed) would better reflect the contribution to uncertainty of EPA's assumption of perfect substitution for residual oil. This change reflects the reported saturation of the bio-glycerin market in recent years (Unnasch, Sanchez et al. 2011). As noted above, making this adjustment would lower EPA's emissions benefits for PME from 17% to 15%.

6.4.1.2 EPA ignores fossil carbon in palm methyl ester to achieve lower emissions results.

Carbon from fossil-based methanol enters into the fuel in the transesterification process, which must be counted at the tailpipe (Hassan, Jaramillo et al. 2011; Unnasch, Sanchez et al. 2011). In Malaysia, Hassan et al. estimate this fossil carbon to contribute 4.2 g CO_2e MJ^{-1} to the final palm biodiesel. Unnasch et al. similarly estimate 3.7 g CO_2e MJ^{-1} of PME (Unnasch, Sanchez et al. 2011, p. 31). Adding this factor to EPA's analysis reduces the benefits of PME from 17% to 12%.

5.4.2 EPA uses over optimistic displacement values for naptha related to renewable diesel.

EPA assumes that co-produced naphtha displaces conventional gasoline on a MJ-for-MJ basis. To examine the contribution to uncertainty of EPA's assumption, it should allow for an actual displacement of between 75% and 100%. Adding this factor to EPA's analysis reduces the benefits of renewable diesel by 1%.

6 EPA's analysis excludes other negative impacts of expanded conversion of tropical forests to palm oil plantations.

We understand that the RFS and EPA's analysis of palm oil under the RFS is focused on GHG reductions. However, according to ISO 14040/14044, any life cycle assessment should include all relevant environmental indicators. Toward this end, making decisions based on only one environmental criterion is extremely short-sighted, especially when 90% of palm oil production operations occur in countries with land critical to global biodiversity. In addition to biodiversity and habitat loss for tigers, orangutans, and rhinoceros and many other tropical species, we would also encourage the EPA to consider parameters including water use, nutrient management and run-off, pesticide usage and soil erosion and their potential for impacting local terrestrial and aquatic ecosystems, as well as human health considerations.

Most of the peat swamps in South East Asia have been logged and cleared, either for plantations or in the case of Malaysia, for urban development. In addition to releasing large amounts of sequestered carbon, the draining of peat lands increases the risk of slow-burning fires, causing airborne haze that has plagued the Southeast Asian region since 1997-1998. The fires and haze are estimated to have caused US$9 billion worth of damage in one year and led to over 500,000 people seeking medical treatment for respiratory ailments[2].

Peat swamp forests are also a distinct ecosystem containing endemic and important species. Peat swamps contain species adapted to living in a water-logged ecosystem, with high acidic and anaerobic soils. In Sumatra, peat swamp forests are also habitat to the critically endangered Sumatran tigers. In both Sumatra and Borneo, they provide habitat to orang utans (*Pongo pygmaeus*). In Sarawak, species occuring in the peat swamp include Storm's Stork (*Ciconia stormi*), the red-banded langur (*Presbytis melalophos cruciger*) and the proboscis monkey (*Nasalis larvatus*). Peat swamp forests are also home to ramin (*Gonystulus bancanus*), a timber species, which is currently listed under CITES Appendix III, for the purpose of managing the trade in that species to prevent extinction. The peat swamp forests are also important in stabilizing water levels and buffering inland areas against saline intrusion into agricultural and water catchment areas, especially when peat forests occur in coastal areas.

The increasing expansion of Malaysian palm plantations into Sarawak also raises important human and indigenous rights concerns. Within the 2 million ha that Sarawak has targeted for palm oil cultivation by 2020, there are plans to target Native Customary Rights (NCR) land under a new Joint Venture development strategy managed under a land trustee, the Land Consolidation and Development Authority (LCDA). Under this initiative, the NCR lands would be consolidated to at least a minimum of 5,000ha and a single land title will be issued to the Sarawak Land Development Board (SLDB) and the Land Custody and Development Authority (LCDA) to act as Trust Agents with power of attorney for the NCR landowners, which can form joint-venture companies with foreign or local private plantation companies, over a period of 60 years. The equity share for the joint-venture company would be: 60% company, 10% State land agency and 30% NCR landowners.

[2] http://www.aseanpeat.net/index.cfm?&menuid=94&parentid=92

These plans raise serious concerns that, with the power of attorney being transferred to the joint-venture company, the indigenous communities are not entitled to be part of the Joint Venture Board or any of the decision-making on their land. Secondly, upon the expiry of 60 years, the communities are required to 'reapply' to the Land and Survey Department for the grant over their own land. This would mean that the indigenous community would have lost their NCR land after the joint-venture period.

Sarawak's reputation and past experiences in land tenure and relations with indigenous communities have often been poor, with many corruption cases and human rights abuses going back to the 1980s. Conflicts over land were initially with logging and timber concessions and now include oil palm plantations. The Sarawak government admits that some 1.5 to 2.8 million ha of land are subject to Native Customary Rights, but most of the NCR land has yet to be mapped or demarcated. This creates confusion and uncertainty, as most communities are unsure of whether their NCR is officially recognized by the government. Additionally, a series of laws and regulations continues to limit the determination of NCR by freezing their extension without permit and interpreting them as weakly secured use rights on state lands[3]. There is a lack of clarity on the methods by which the benefits will be provided to the landowners and how disputes about compensation would be resolved: there are now about 100 cases in the Sarawak courts filed on behalf of the native communities[4].

[3] Colchester, Marcus. 2010. Palm Oil and Indigenous Peoples of South East Asia: land acquisition, human rights violations and indigenous peoples on the palm oil frontier. *Forest Peoples Programme*. 22pp. (http://www.rightsandresources.org/documents/files/doc_1680.pdf)

[4] Marcus Colchester, Wee Aik Pang, Wong Meng Chuo and Thomas Jalong. 2007. Land is Life: Land Rights and Palm Oil Development in Sarawak. Forest Peoples Programme and SawitWatch, Bogor. 112pp. (http://www.forestpeoples.org/sites/fpp/files/publication/2010/08/sarawaklandislifenov07eng.pdf).

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Appendix 1

Global Palm Oil Production and Consumption

Production	(000's Mtons) 2007/08	2008/09	2009/10	2010/11	% Change 07-11
Indonesia	18000	20500	22000	23600	31%
Malaysia	17567	17259	17763	18215	4%
Thailand	1050	1540	1345	1288	23%
Colombia	780	795	770	775	-1%
Nigeria	820	850	850	850	4%
Other	2867	3048	3134	3202	12%
Total	41084	43992	45862	47930	17%

Domestic Consumption	(000's Mtons) 2007/08	2008/09	2009/10	2010/11	% Change 07-11
India	5075	6230	6440	7135	41%
Indonesia	4704	4855	5424	6670	42%
China	5222	5618	5930	5797	11%
EU-27	4717	5220	5210	5150	9%
Malaysia	3170	3229	3389	3416	8%
Pakistan	1816	1953	1971	2050	13%
Nigeria	1190	1208	1232	1240	4%
Bangladesh	797	700	911	1035	30%
Thailand	943	1229	1297	989	5%
United States	948	959	958	956	1%
Egypt	540	740	885	920	70%
Colombia	515	615	777	775	50%
Iran	519	551	552	619	19%
Russia	705	584	527	600	-15%
Japan	551	531	581	575	4%
Other	7906	7886	8435	9450	20%
Total	39318	42108	44519	47377	20%

Global Ending Stocks	4138	4891	5383	5085	
Stocks/Usgage	10.5%	11.6%	12.1%	10.7%	

Source: USDA