SUSTAINABLE FINANCE PROGRAMME

SMITH SCHOOL OF ENTERPRISE AND THE ENVIRONMENT

UNIVERSITY OF OXFORD

Stranded Assets in Palm Oil Production:

A Case Study of Indonesia

Working Paper

July 2016

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About the Sustainable Finance Programme

The Sustainable Finance Programme at the University of Oxford's Smith School of Enterprise and the Environment was established in 2012 (originally as the Stranded Assets Programme) to understand how finance and investment intersects with the environment and sustainability.

We seek to understand the requirements, challenges, and opportunities associated with a reallocation of capital towards investments aligned with global environmental sustainability. We seek to understand environment-related risk and opportunity, both in different sectors and systemically; how such factors are emerging and how they positively or negatively affect asset values; how such factors might be interrelated or correlated; their materiality (in terms of scale, impact, timing, and likelihood); who will be affected; and what affected groups can do to pre-emptively manage risk.

We recognise that the production of high-quality research on environment-related factors is a necessary, though insufficient, condition for these factors to be successfully integrated into decision-making. Consequently, we also research the barriers that might prevent integration, whether in financial institutions, companies, governments, or regulators, and develop responses to address them. We also develop the data, analytics, frameworks, and models required to enable the integration of this information into decision-making.

The Programme is based in a world leading university with a global reach and reputation. We work with leading practitioners from across the investment chain (including actuaries, asset owners, asset managers, accountants, banks, data providers, investment consultants, lawyers, ratings agencies, stock exchanges), with firms and their management, and with experts from a wide range of related subject areas (including finance, economics, management, geography, anthropology, climate science, law, area studies, psychology) within the University of Oxford and beyond.

Since 2012 we have conducted pioneering research on stranded assets and remain the only academic institution conducting work in a significant and coordinated way on the topic. We have created the Stranded Assets Research Network, which brings together researchers, research institutions, and practitioners working on these and related issues internationally to share expertise. We have also created the Stranded Assets Forums, which are a series of private workshops to explore the issues involved.

About the Authors

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Acknowledgements

We would like to thank Craigmore Sustainable for providing a grant to support this research. We would also like to thank Duncan Macdonald-Korth (Oxford Smith School) for his research assistance.

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Executive Summary

Caldecott et al. (2013) outlined how different environment-related risks could affect agricultural assets in different ways and on different time scales. These risk factors could be a result of the physical environment, driven by climate change, ecosystem service loss and land degradation, and water scarcity. Economic drivers include political and regulatory change, as well as issues of environmental and social responsibility.

They also proposed a typology of different assets in agriculture: natural assets (e.g. farmland water); physical assets (e.g. crops, farm infrastructure); financial assets (e.g. farm loans); human assets (e.g. management practices) and social assets (e.g. networks). Their research found that environment-related factors are material and have the potential to create a significant number of 'stranded assets' in the agricultural supply chain. Stranded assets are assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities.[1]

In this working paper we focus on the environment-related risk factors that can cause asset stranding in the national context of Indonesia's oil palm industry. We have attempted to review what we feel are the most pressing environment-related concerns as well as the international financial efforts to bring greater transparency to the sector. This is an industry that requires close inspection and at times may seem impossible to differentiate, but there are some credible actors making serious efforts to improve their environmental and social impacts and others that need greater pressure exerted on them to improve.

Environment-related risks in the palm oil value chain in Indonesia

Following the framework set out by Caldecott et al. (2013), we have conducted an initial literature-based assessment of environment-related risk factors that could impact financial, human, natural, physical, and social assets along the Indonesia palm oil value chain. We have sought to understand the materiality of these risk factors, in terms of likelihood, timing, and potential scale of impact.

Figure 1: Asset stranding risk framework by asset category. From Caldecott, et al. (2013)

[1] Caldecott, Howarth, and McSharry, "Stranded Assets in Agriculture : Protecting Value from Environment-Related Risks."

The risks we consider are split into two groups, physical or economic. They include: land degradation and declining ecosystem services; fire and air pollution; weather variability and climate change; GHG targets and regulations; biofuel policies; land use regulations; and pressures from sustainable development and green industry paradigms. Assets associated with the palm oil value chain (see Figure 1) are affected in different ways and to different extents by these risk factors.

Natural assets include the farmland itself, water resources, biodiversity, and general ecosystem service. Physical assets refer to the plantation crops, infrastructure, and other processing facilities. Financial assets would include investments and financial derivatives of the commodity. Human assets refer to the knowledge and expertise around agricultural technologies and the management practices and experience. Finally, social assets cover policy, business, consumer, and community networks that hold sway in the license to operate for the palm oil industry.

For each risk factor, we have evaluated the level of vulnerability using an environmental risk assessment and management framework[2] and a traffic light rating system (see Table 6). In the context of oil palm, sensitivity to each environment-related risk ranges from red (high vulnerability) to green (low vulnerability). This is a product of the likelihood of an event happening and the severity of the consequences, determined by considering probability of occurrence within the next 30 years (based on the planting cycle of oil palm plantations) and what proportion of the sector could be impacted. These are our initial subjective assessments based on literature reviews and should be treated as such. Future analysis could attempt to quantify probability and severity with more specificity and certainty.

Table 1 summarises our assessment of how different environment-related risks might impact different assets in the Indonesia palm oil value chain.

Table 1: Summary of Physical and Economic Risks

Key: 🔴 +3 🟠 +2 🟡 +1 🟢 +0	Physical Assets	Social Assets	Financial Assets	Human Assets	Natural Assets	Combined (/15)
Land degradation, deforestation, or habitat loss	🟠	🟠	🟡	🟡	🔴	9
Fire and Air Pollution/Haze	🟠	🟡	🟡	🔴	🔴	10
Weather Variability and Climate Change	🟠	🟠	🟠	🟠	🟡	9
Greenhouse Gas Regulations	🟠	🟡	🟡	🟡	🟢	5
Emergent biofuel policies	🟢	🟡	🟢	🟠	🔴	6
Land use policy	🟠	🔴	🔴	🟠	🟠	12
Reputational risks	🟠	🟠	🟠	🟠	🟡	9
TOTAL (/21):	**12**	**12**	**9**	**13**	**13**	

Initiatives aiming to reduce environment-related risk

To see how different private sector initiatives might prevent stranded assets in the Indonesian palm oil sector we examined a number of initiatives concerned with improving the environmental practices of the palm oil sector. The initiatives were assessed for their ability to address environment-related risk.

[2] e.g. Gormley et al., "Guidelines for Environmental Risk Assessment and Management. Green Leaves III."

We performed a desk-based analysis and assessed which environment-related risk factors are a criterion for different initiatives, if there were clear recommendations or targets, and whether explicit guidance was provided. We collated these scores, showing how each initiative scores across our risk factors ('0' indicates the risk was not addressed, '1' mentioned with no clear recommendations or targets, and '2' that there was explicit guidance provided around the particular risk area.)

Table 2: Comparison of initiatives aiming to reduce environment-related risk

Key: 🟢 +2 Explicit Guidance 🟡 +1 Mentioned w/o Target 🔴 +0 Risk not Assessed	RSPO	ISPO	ISCC	HCS	BEI & CGF *	CDP FP	PRI *	Thun Grp.	Combined Initiatives
Land Degradation	🟢	🟡	🟢	🟡	🟢	🟢	🟢	🔴	🟢
Weather Variability	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🔴	🟡
Fire and Air Pollution	🟢	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🟢
GHG Regulation	🟡	🟡	🟢	🟢	🟡	🟢	🟡	🔴	🟢
Biofuel Policies	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🟢
Land Policy and Patronage	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟢	🟢
Increasing Production Costs	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡
Reputational Risks	🟢	🔴	🟡	🟡	🟢	🟢	🟢	🟢	🟢
TOTAL (/16):	**10**	**4**	**10**	**4**	**10**	**10**	**10**	**4**	**14**

* Risk score for the initiative rely entirely on companies being RSPO certified

While the RSPO is still considered the most comprehensive in addressing the risk factors outlined in this report, its historically limited enforcement has threatened its legitimacy to investors and observers. Efforts like the CDP and ISCC are monitoring many of the important drivers, but the former has no enforcement powers to change unsustainable behaviour and the latter only applies to a subset of relevant plantations. The ISCC has limited its impact by focusing on international biofuel trade as a potential driver of large-scale deforestation. Finally, the ISPO has demonstrated the least potential to address any of the drivers of stranded assets identified, and therefore, should not be expected to bring about large-scale reform of the Indonesian oil palm sector.

Indonesia's specific challenge of entrenched patronage politics remains a central issue despite these initiatives. Voluntary or international commercial initiatives have very limited ability to challenge national government's sovereignty. There are signs that the Indonesian authorities are keen to change this dynamic, such as through its significant GHG commitments and constitutional ruling on respecting customary land claims. Conversely, its movement toward limiting foreign ownership of plantations and development of the ISPO may be perceived as a means of reducing external oversight of its palm oil sector, further entrenching current businesses practices. One key finding is that there do not appear to be any ESG initiatives to directly address potential impacts of climate change on the productivity of the palm oil sector.

Assessing investor and company exposure

In order to develop a sense of the extent to which these risk factors are of concern and being addressed by companies and investors, we examined the top 20 palm oil companies (see Table 3 below), ranked based on net income from Bloomberg and listed by the proportion of Indonesia's total planted area, as well as their engagement with producer-focused ESG initiatives (e.g. RSPO, ISPO, ISCC, HCS and CDP FP). We posit

that palm oil companies are engaging with these initiatives in order to lessen their exposure to reputational risk or because they have been pressured to improve their transparency and/or ESG record for international investors. Due to the lack of transparency across such an undifferentiated supply chain, more responsible companies are keen to distinguish themselves from the industry at large. Combined the 20 companies we have chosen are directly responsible for around 30% of total planted oil palm areas in Indonesia and total crude palm oil, and nearly three-quarters of palm oil market share (Musim Mas and Cargill comprise most of the remaining). It is interesting to see that most of these companies have engaged with the RSPO, ISPO, and ISCC, with only very few involved with the CDP Forest Program.

Table 3: Listing of top 20 Indonesian palm oil companies with details of certification and third-party evaluations

Company	Net Income ($mil.)	% Indo Planted Area	RSPO	ISPO	ISCC	HCS	CDF FP*	SPOTT	Green Tigers
Golden Agri Resources (GAR)	383.7	4.50%	Y	Y	Y	Y	NR	63.60%	GOOD
Salim Ivomas Pratama Terbuka PT**	53.4	3.20%	Y	Y	-	-	NR	46.00%	POOR
Astra Agro Lestari Terbuka PT	116.3	2.70%	-	Y	-	-	NR	14.50%	POOR
Sime Darby Plantation	669.1	2.70%	Y	Y	Y	-	NR	63.60%	UNCLEAR
IndoAgri	48.8	2.40%	Y	Y	-	-	-	-	POOR
First Resources Limited	141.6	1.90%	Y	Y	Y	-	NR	20.00%	POOR
Genting Plantations Berhad	61.8	1.70%	N	Y	-	-	NR	29.10%	-
Wilmar Group	893	1.60%	Y	Y	Y	Y	Y	45.50%	GOOD
Bumitama Agri Limited	45.4	1.40%	Y	Y	-	-	NR	30.90%	UNCLEAR
Austindo Nusantara Jaya	32.2	1.30%	Y	Y	Y	-	NR	-	-
Sinar Mas (SMART)**	62.8	1.30%	Y	Y	Y	-	NR	63.60%	GOOD
PP London Sumatra Terbuka PT	57.4	1.20%	Y	Y	-	-	NR	43.60%	-
Kuala Lumpur Kepong Berhad	211.1	1.00%	Y	Y	Y	-	NR	41.80%	POOR
REA Holdings PLC	53.5	1.00%	Y	Y	Y	-	-	-	-
IOI Corporation Berhad	421.2	0.50%	Y	-	Y	-	Y	54.00%	UNCLEAR
SIPEF	46.1	0.40%	Y	Y	Y	-	NR	56.00%	-
Kulim (Malaysia) Berhad	62.3	0.40%	Y	-	-	-	NR	50.90%	-
FELDA	154.9	0.40%	Y	-	-	-	NR	-	UNCLEAR
Socfin Group S.A.	67.9	0.40%	Y	-	-	-	NR	33.60%	-
United Plantations Berhad	56.1	0.20%	-	-	-	-	-	60.00%	-

**NR* refers to "no-response" as reported in (CDP, 2014).
**Salim Ivomas is a subsidiary of IndoAgri and SMART is a subsidiary of GAR
Note: Companies are listed in order of percent of total Indonesian planted area and whether any of their operations are RSPO, ISPO or ISCC certified. Their involvement with the HCS initiative and reporting to the CDP FP is noted. Finally, rating of their sustainability performances by the Sustainable Palm Oil Transparency Toolkit (SPOTT) and Green Tigers are presented.

In addition, there have been several systematic assessments made of some of these large companies by a number of NGOs. These have been primarily desk-based analyses, looking at documented policies on a range of sustainability indices[3] (e.g. the Zoological Society of London's Sustainable Palm Oil Transparency Tool (SPOTT)) mostly based on declared zero deforestation policies (e.g. Forest Heroes Green Tigers report).[4] We use these as proxy measures of environmental and social governance performance for our identified companies. In the case of SPOTT, ZSL provides a detailed framework assigning of points for a number of principles, and resulting in a percentage score and colour code. The Green Tigers report provides

[3] ZSL, "Sustainable Palm Oil Transparency Toolkit."
[4] Hurowitz, "The Green Tigers: Which Southeast Asian Companies Will Prosper in the New Age of Forest Conservation."

three rankings of performance: good, unclear or ambiguous, and poor. These are based on a company's behaviour around protection of forest/high conservation value area, high carbon stock land, peatlands, and human rights. As many of these assessments consider whether a company engages with ESG initiatives, it is not surprising that companies with engagement across all listed initiatives receive higher scores from both SPOTT and Green Tigers.

It is revealing that the only three companies that have received a 'good' report from Green Tigers are involved with RSPO, ISPO, ISCC and in some cases HCS combined. More than half of the companies dubbed 'poor' have only adopted RSPO and/or ISPO certification. Comparing companies' SPOTT scores, the highest average SPOTT score are for companies that are engaged with HCS (55%), as they are generally involved with all of the other schemes as well. Similarly, high average SPOTT scores go to companies engaged with ISCC (51%) and CDP FP (50%). Companies with only ISPO certification score dismally low (22%) and the average RSPO engaged company score (45%) is only marginally improved if they also undertake ISPO (46%).

Conclusions

It is difficult to predict the future state of the Indonesian palm oil sector as many factors are rapidly changing. For one, the Indonesian government has policies regarding curbing national GHG emissions, limiting foreign ownership of palm oil companies, encouraging greater processing within the country through tariffs on export of CPO, and establishing its own national sustainability certification body (e.g. ISPO). Indications are that the current president of Indonesia, Joko Widodo, will work to reduce deforestation rates and protect remaining peatland areas.[5]

President Widodo has stated that he intends to tackle the entrenched political patronage system, which challenges the legitimacy of government efforts like the ISPO and deforestation moratorium. There is certainly evidence that Indonesia's judicial system is supporting that process through its ruling recognising indigenous claims to forest lands illegally claimed by the Ministry of Forestry. On the other hand, the Indonesian government's desire to reduce the proportion of foreign ownership of oil palm plantations may effectively minimise the ability of international entities to pressure the sector on ESG issues.

While demand for palm oil is expected to increase over the long term, growth in demand has slowed. Prices for CPO have remained low, limiting producer companies' ability to invest in better management systems and infrastructure. However, that may be an ideal opportunity for guaranteed CSPO premiums to attract more producers to schemes like the RSPO.

There remain large question marks around the impact of future climate changes on oil palm production. Certainly drought conditions result in reduced yields and by extension reduced company profits. At the same time, projections of climatic conditions in Southeast Asia predict increases in the intensity of rain events, temperature levels and by extension local ozone levels. Agronomic models of oil palm have not been calibrated to assess these factors in coordination; however, it seems highly likely that monthly production levels of FFB will be closely linked to specific weather events and therefore more varied throughout the year. This could have knock-on effects for processers and global volumes of palm oil, as the vast majority of CPO is produced by just Malaysia and Indonesia.

International scrutiny of the oil palm sector regarding biodiversity conservation is closely aligned to ESG concerns and consumer pressure in general. This report outlines a large array of financial and multi-stakeholder initiatives intended to improve the sector's practices. In principle, the fact that 96% of the palm oil trade has made zero-deforestation commitments, would indicate the industry is well on its way toward a wholesale reduction of its GHG emissions. Obviously, in practice that is much more challenging to enforce, with the myriad of smaller enterprises and subsidiaries selling to the large traders and only 30% of

[5] Carrington, "Indonesia Cracks down on Deforestation in Symbolic U-Turn."

Indonesia's actual planted area under direct management of the largest companies we identified. The organisation of the financial sector around greater ESG monitoring should also influence the behaviour of the largest multinational palm oil companies. Again, this will need greater vigilance of actual management activities at the plantation and community level, which will need to go beyond what desk-based assessments tools such as SPOTT or the RSPO have traditionally provided.

However, while the RSPO has been attempting to show stricter enforcement of its principles and criteria a number of other NGOs are providing important oversight of the industry. Between the Global Forest Watch's regularly updated medium resolution satellite imagery, BankTrack's following of financial backers of the palm oil sector and its ESG infractions and Chain Reaction Research's producing detailed reports of environmentally intensive commodity companies; there are resources available for interested investors to follow the performance of specific companies. This may be the new normal until the Indonesian government is able or willing to provide adequate oversight of the sector, which key financial actors are increasingly expecting.

1 Introduction

Caldecott et al. (2013) outlined how different environment-related risks could affect agricultural assets in different ways and on different timescales. These risk factors could be a result of the physical environment, driven by climate change, ecosystem service loss and land degradation, and water scarcity. Economic drivers include political and regulatory change, as well as issues of environmental and social responsibility. The report also proposed a typology of different assets in agriculture: natural assets (e.g. farmland water); physical assets (e.g. crops, farm infrastructure); financial assets (e.g. farm loans); human assets (e.g. management practices) and social assets (e.g. networks). The research found that environment-related factors are material and have the potential to create a significant number of 'stranded assets' in the agricultural supply chain. Stranded assets are assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities.[6]

Many of the environment-related risks examined in the 2013 paper can be found in the oil palm value chain. Palm oil is a ubiquitous commodity used as cooking oil, an additive in processed foods and a source of glycerine for soaps and pharmaceuticals. It is one of the few agricultural commodities where the majority of its volume is exported rather than consumed domestically.[7]

Natural assets are critical to the success of palm oil production. The tropical crop relies on certain bioclimatic conditions and environmental services, such as water provision and soil fertility, as will be discussed in this working paper. The most important climatic factor driving potential oil palm yield is solar radiation; however, with increasing temperatures and less consistent rainfall predicted it is unclear what future yields will be. There are a series of physical assets required for the production and distribution of oil palm products, traded as crude palm oil (CPO), crude palm kernel oil (CPKO), refined palm oil (RPO) and manufactured goods[8] (see Figure 2).

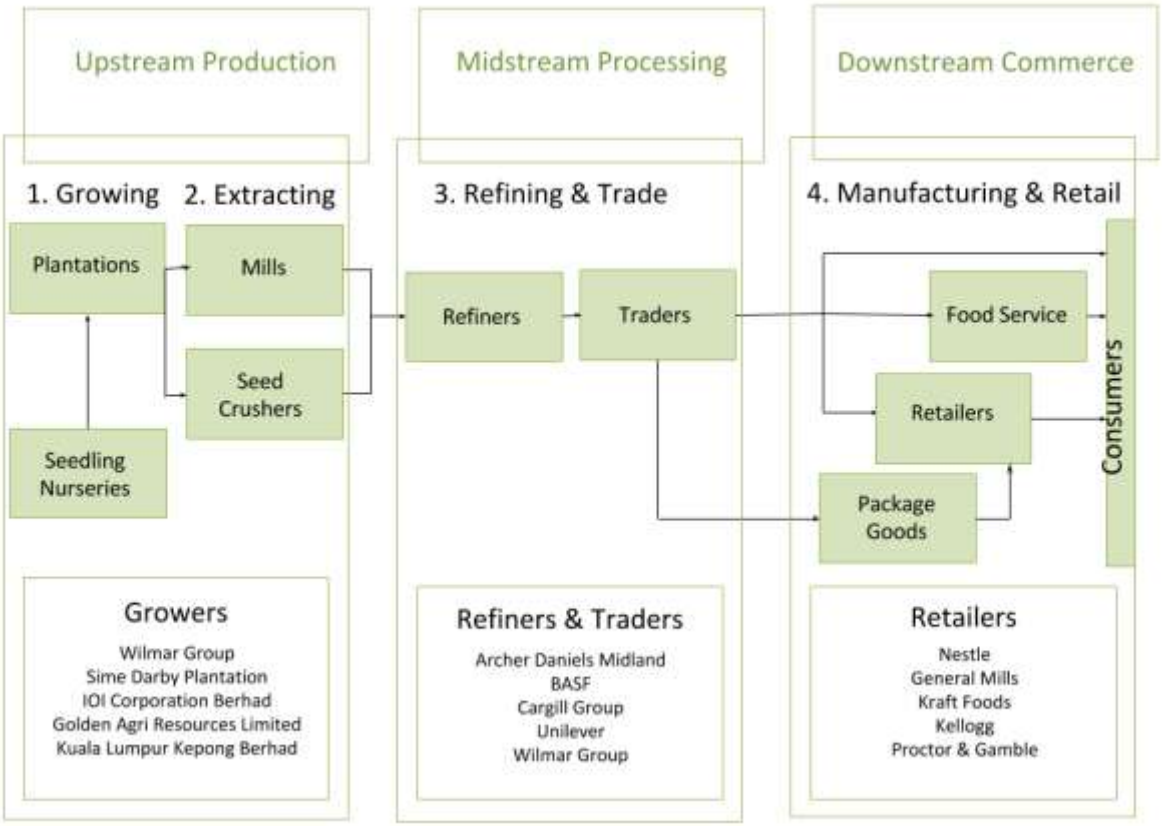
Financial assets include debt and equity associated with palm oil companies, financial derivatives of commodities, and ownership of entitlements, such as water rights. The investor base in the global palm oil sector appears to be highly concentrated, with 80% of traded stocks in palm oil controlled by 20 asset owners.[9] While over half of these investors are considered family or founders, institutional investors own approximately 23% of total equity and are primarily located in Asia (65%), Europe (24%), and North America (11%). The majority of listed companies are found on Malaysian, Singaporean, and Indonesian exchanges (90% of total market capitalisation).

Human assets include research and development, new technologies, and management expertise. There are a number of research centres devoted to oil palm production and processing, including the National Research Centre for Oil Palm in India, the Indonesian Oil Palm Research Institute (IOPRI) and the Malaysian Palm Oil Board (MPOB), which provide expertise in best management practice in oil palm cultivation and processing, as well as research into biotechnology and breeding.[10] Studies by international organisations into more energy efficient processing technology have also added to the growing knowledge around oil palm production.[11]

[6] Caldecott, Howarth, and McSharry, "Stranded Assets in Agriculture : Protecting Value from Environment-Related Risks."
[7] Oosterveer, *Global Governance of Food Production and Consumption: Issues and Challenges*.
[8] Accenture for Humanity United, "Exploitative Labor Practices in the Global Palm Oil Industry."
[9] Grayson and Stampe, "Palm Oil Investor Review: Investor Guidance on Palm Oil."
[10] Malaysian Palm Oil Board website. http://www.mpob.gov.my/
[11] IRG Philippines, "Scoping Study Clean Technology Opportunities and Barriers in Indonesian Palm Oil Mill and Rice Mill Industries."

Social assets, such as networks, standards, and industry norms, are receiving increased attention and this has been driven by a desire to manage company-specific reputational risk, which has become more material due to increased scrutiny by investors and civil society of companies' environmental, social, and governance (ESG) performance.[12] Networks in the policy sphere have arisen (for example, the Roundtable on Sustainable Palm Oil) to help address ESG concerns and ratchet up company performance over time. End consumer pressure has also played a significant role in this, though primarily from developed country markets in Europe and North America, where the majority of companies using sustainable palm oil are located.[13]

Figure 2: Schematic of palm oil processing. (Adapted from: Wilmar 2013)[14]



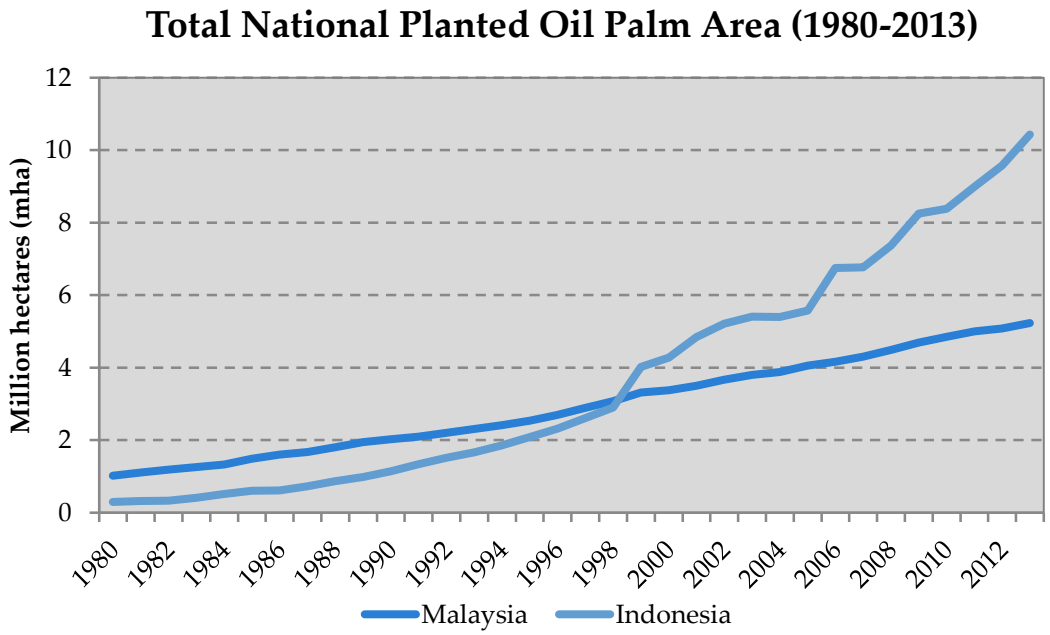
1.1 Indonesia

In this working paper we focus on the environment-related risk factors that can cause asset stranding in the national context of Indonesia's oil palm industry. On some level, the distinction between the Indonesian and Malaysian oil palm industries is a moot point, considering there is significant overlap between companies operating in both countries (see Section 5.1, Market Analysis). The two countries currently produce 85-90% of global palm oil volumes; however, Indonesia has exhibited a significantly faster rate of growth in planted area (Figure 3). This expansion has too often been at the expense of local community land claims, valuable habitat for endangered species (e.g. Sumatran orangutan and Sumatran tiger), and caused the release of considerable carbon emissions through cultivation of peatlands. When considering emissions from land use

[12] Hospes, "Marking the Success or End of Global Multi-Stakeholder Governance? The Rise of National Sustainability Standards in Indonesia and Brazil for Palm Oil and Soy."
[13] WWF, "Palm Oil Buyers Scorecard: Measuring the Progress of Palm Oil Buyers.".
[14] Wilmar, "Sustainability Report 2013: Transformation through Engagement."

and land cover change (LULC), Indonesia is the fifth highest emitter in the world, but has recently made relatively aggressive commitments to reduce net emissions. Several of its largest companies are involved with the internationally recognised Roundtable on Sustainable Palm Oil (RSPO), yet due to concerns over the slow progress of RSPO Indonesia launched its own sustainability certification body, ISPO, in 2009. Its governance structure has been accused of being dominated by patronage politics and lacking transparency as well as reducing the incidence of foreign ownership.

Figure 3: Schematic of palm oil processing. (Source: MPOB and Deptan)



There are so many competing developments and dynamics occurring in this populous archipelago nation, it remains difficult to predict what will result. In this working paper, we attempt to review what we feel are the most pressing environment-related concerns as well as the international financial efforts to bring greater transparency to the sector. This is an industry that requires close inspection and at times may seem impossible to differentiate, but there are some credible actors making serious efforts to improve their environmental and social impacts and others that need greater pressure exerted on them to improve.

1.2 Structure

This working paper aims to identify and then provide an initial assessment of the environment-related risks facing financial, human, natural, physical, and social assets along the Indonesia palm oil value chain. Section 2 provides background on the palm oil industry globally and in Indonesia specifically. This covers the economic and physical geography of the palm oil industry and the phases of its expansion. Section 3 introduces the framework employed, includes risk factors and asset types, as well as our methodology. It assesses the environment-related drivers of asset stranding and provides an initial view on their level of materiality. This section is divided into physical and economic drivers. Section 4 assesses the extent to which these risks are currently being addressed and reviews Environmental, Social, and Governance (ESG) initiatives related to the Indonesian palm oil value chain and whether these are a suitable response to the threat of asset stranding from environment-related factors. In Section 5 we look at the actors involved in the Indonesian oil palm oil value chain and examine the extent to which they are addressing these issues. We conclude with some suggestions and signposts for further research.

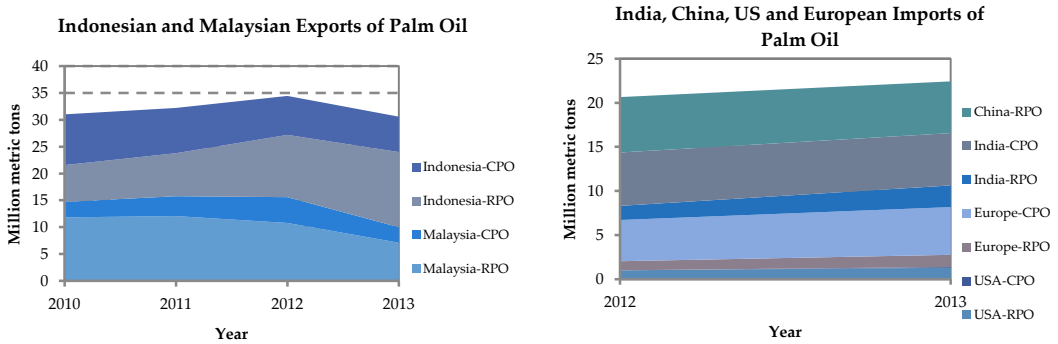
2 The palm oil industry in Indonesia

Palm oil's prominence is a relatively recent phenomenon. A ninefold increase in palm oil production between 1980 and 2010 is related to a number of factors: WTO requirements to reduce subsidies for soybean oil; increased demand from China and India; the EU's mandate for labelling of GM crops causing a shift away from soybean oil; and a move away from trans-fat oils like soybean to canola and palm oil.[15] Part of its rapid growth may also be due to the trade in processed foods increasing at a faster rate than primary agricultural products.[16] Demand for vegetable oils worldwide is expected to continue expanding, due to growing global population and affluence in urban areas where consumption of processed foods, cooking oil, and cosmetics will likely increase.[17]

Before 1972, Europe imported 70% of the world's palm oil,[18] but this has fallen to around 20%[19]. More recently, Indonesia overtook India as the largest consumer of palm oil in 2013, consuming 17% and 15% of global supply respectively.[20] Southeast Asia dominates palm oil production. Together Indonesia and Malaysia produce 84% of global palm oil,[21] with Indonesia leading in volumes of both crude palm oil (CPO) and refined palm oil (RPO) (see
Figure 4).

Ninety per cent of Southeast Asian oil palm companies are listed on stock exchanges primarily in Malaysia and Singapore. While previous reports showed a market capitalisation of US$7 billion in 2005,[22] the total valuation has increased significantly over the past decade. In 2015, the top ten constituents of the FTSE Bursa Malaysia Asian palm oil plantation index had a combined market capitalisation of US$95 billion.[23] As data in Appendix A shows we construct a sample that covers the majority of the Asian market, with a combined market capitalisation of US$85.9 billion. Appendix A also shows that the proportion of Free Float Shares for the sample used in this report varies between zero to 100%, with a median of 36.7% of shares outstanding.

Figure 4: Exports of RPO and CPO from top producers and imports of RPO and CPO for top consumer.[24]



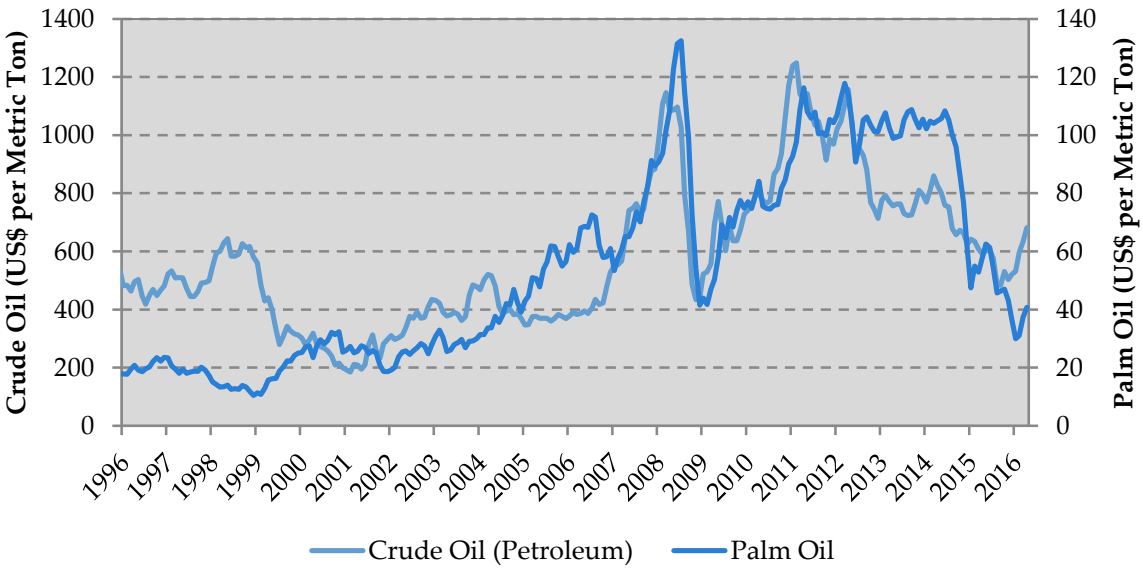
[15] Sanders, Balagtas, and Gruère, "Revisiting the Palm Oil Boom in South-East Asia: Fuel versus Food Demand Drivers."
[16] Liapis, "Changing Patterns of Trade in Processed Agricultural Products."
[17] Wheeler et al., "Economic Dynamics and Forest Clearing: A Spatial Econometric Analysis for Indonesia."
[18] Voituriez, "What Explains Price Volatility Changes in Commodity Markets? Answers from the World Palm-oil Market⋆."
[19] FAOStat, "Trade Statistics."
[20] USDA, "Production, Supply and Distribution (PSD) Online."
[21] FAOStat, "Production Statistics."
[22] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[23] FTSE, "FTSE Bursa Malaysia Index Series: Monthly Report – January 2016."
[24] "UN Commodities Trade Statistics Database."

Box 1 provides an overview of palm oil production. Trade between Indonesia, Malaysia, and China has continued to increase following the establishment of the ASEAN tariff rate quota (TRF), which has made the palm oil trade tariff free since 2010.[25] Over 90% of the palm oil China imports is RPO, which comes largely from Malaysia. The majority of Indonesian exports are CPO. India is a more price-sensitive market than China, relying on CPO as cooking oil rather than as an ingredient for processed food and imports over 80% of its CPO from Indonesia.[26] The Indonesian government has recently incentivised greater domestic processing by increasing the cost of trading CPO and CPKO and the implications of this on CPO exports to India are unclear.[27]

At the same time, palm oil is being used increasingly as a biofuel feedstock. Non-food uses of palm oil relative to food uses have increased from 16% to 26% during 2003-13.[28] The production of biofuels from palm oil was at its most attractive in 2005 when crude oil prices surpassed CPO prices per metric ton (see Figure 5). Since then the opposite has been the case. As a result, production levels of biodiesel have been maintained primarily via government subsidies and targets (see Table 4).[29]

There are considerable uncertainties around the use of biodiesel in the future, not least diesel demand, especially after the Volkswagen scandal in late 2015, which looks set to reduce demand for diesel engines and to speed up the uptake of electric vehicles and hybrid electric vehicles.

Figure 5: Price of Oils (Data source: IndexMundi, 2016)[30]



[25] Rifin, "Analysis of Indonesia's Market Position in Palm Oil Market in China and India."
[26] Ibid.
[27] Accenture for Humanity United, "Exploitative Labor Practices in the Global Palm Oil Industry."
[28] Sanders, Balagtas, and Gruère, "Revisiting the Palm Oil Boom in South-East Asia: Fuel versus Food Demand Drivers."
[29] Sayer et al., "Oil Palm Expansion Transforms Tropical Landscapes and Livelihoods."
[30] IndexMundi, "Palm Oil vs Crude Oil (petroleum) - Price Rate of Change Comparison."

Table 4: Biodiesel Targets (Source: Biofuels Digest 2014)[31]

Country	Biodiesel Target	Year
Australia	Mandated Ethanol 2% (NSW)	2011
Brazil	Mandated 5%	2015
Canada	Mandated 2%	2012
China	Target 10%	Target 2020
EU	Renewable Transport Fuel 10%	Target 2020
India	Mandated Ethanol 5% Target 20%	Target 2017
Indonesia	Mandated 5%	2014
	Target 15%	2015
Malaysia	Mandated 5%	2014
USA	Biomass-based Diesel 1.90bn gal/ 1.5%	Target 2017
Norway	Mandated 3.5%	2012
The Philippines	Mandated 5%	2015
South Africa	Mandated 5%	2015
Australia	Mandated Ethanol 2% (NSW)	2011

Table 5: Proportion of provincial and national planted area by owner category (e.g. smallholder, government and private enterprise) and average yield by category per province, (Source: Directorate General of Estates, Department of Agriculture, 2010).

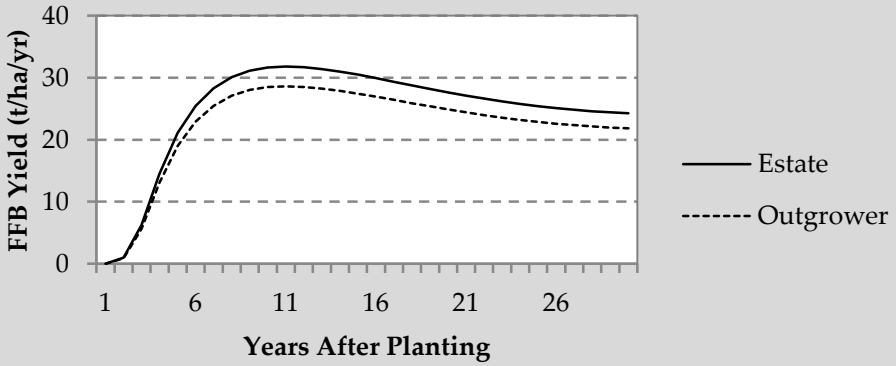
Province	Smallholders		Government		Private Enterprise	
	% Planted Area	Average Yield (t CPO/ha)	% Planted Area	Average Yield (t CPO/ha)	% Planted Area	Average Yield (t CPO/ha)
Sumatra	46	3.6	11	4.1	43	4.1
Java	28	2.7	51	3.1	20	3.9
Kalimantan	28	2.6	5	3.5	66	3.5
Sulawesi	40	3.3	10	2.6	50	4.0
Maluku-Papua	46	2.8	46	2.9	8	3.4
Indonesia (Total)	42	3.4	10	3.9	48	3.9

Box 1: Palm Oil Production

Oil palm (*Elaeis guineensis*) is the source of palm oil and originates from West Africa. It became a globally important commodity during the industrial revolution[32] and expanded as an industrial plantation crop in Southeast Asia after the 1960s.[33] Today it is the most commercially productive oilseed per hectare, yielding ten times more per hectare than its closest competitor, soybean oil. However, there are still significant yield gaps in both industrial and small-scale production systems.[34] While oil palm cultivation remains one of the most lucrative land-uses in the tropics, driving investment in plantations in Southeast Asia, West Africa and South America,[35] the cost of production continues to increase, as it remains a labour intensive crop with few opportunities for mechanisation.[36]

[31] Lane, "Biofuels Mandates Around the World: 2015."
[32] Ibid.
[33] Ibid.
[34] Henderson and Osborne, "The Oil Palm in All Our Lives: How This Came about"; Moll, *The Economics of Oil Palm*.
[35] Henderson and Osborne, "The Oil Palm in All Our Lives: How This Came about."
[36] Wheeler et al., "Economic Dynamics and Forest Clearing: A Spatial Econometric Analysis for Indonesia."

Figure 6: Showing idealised yield profiles for industrial and affiliated smallholder palm oil operations (assuming 90% lower productivity) over a 25-year productive cycle. Data from Henson[2]



Oil palm grows best in humid, tropical, and lowland areas with a minimum average rainfall of 2,000mm evenly distributed throughout the year. Oil palm cannot withstand more than three successive months of less than 100mm rainfall. It requires a temperature range of 24-30°C, becoming significantly less productive above temperatures of 35°C.[37] It can be grown on a wide range of soils, though is best adapted for tropical soils, as long as adequate soil moisture is maintained.[38] Low nutrient availability can be overcome with significant fertiliser application, and oil palm has a relatively high tolerance for acidic soils that would normally be unsuitable for other crops.[39]

The production cycle of oil palm lasts approximately 25 years (see

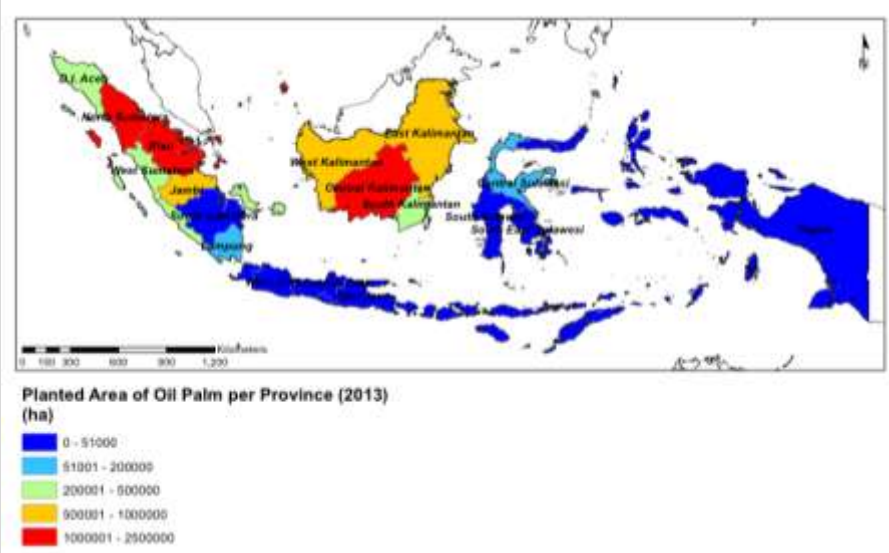
Figure 6). The first three to four years are dedicated to plantation establishment, during which nursery-reared oil palm seedlings are planted (approx. 140 palms ha^{-1}). The productive phase of the plantation is between four and 30 years. In the fourth year a healthy palm may produce 15-25 fresh fruit bunches (FFB); however, by its twelfth year this will decrease to ten bunches. At the same time, the weight of one FFB will increase with the age of the palm from 5 kg in the fourth year to 20-25 kg in the fourteenth year.[40] After 20 years, not only does the yield of the palms reduce, but the palms also become too tall for manual harvesting. Oil palm is very labour intensive to harvest, requiring stooping to pick fallen loose fruits, harvesting FFBs at height ranging in weight and pushing heavy wheelbarrows to roads for later collection.[41] Labourers are expected to work ten-day rounds per area, which equates to roughly one worker per ten ha.[42]

After the establishment of the plantation it is necessary to build a mill, where FFB can be processed into CPO within 48 hours of being harvested, otherwise too many free fatty acids (FFA) collect in the fruitlets. Processing FFB is a very water intensive activity that removes the fleshy mesocarp of the fruit from the palm kernel seeds. Oil can be extracted from both the fruit and the kernels. Rates of extraction of CPO from FFB have changed little over the last few decades, hovering around 20-23%, while significant efficiency improvements have been realised in extraction of palm kernel oil (PKO).[43] The mills are generally powered by burning biomass, such as empty fruit bunches (EFB) (e.g. processed FFB) and palm kernel shells. The excess wastewater from the process is then released as palm oil mill effluent (POME), which can be used as

[37] Ibid.
[38] Ng et al., "Ergonomics Observation: Harvesting Tasks at Oil Palm Plantation."
[39] Paterson, Sariah, and Lima, "How Will Climate Change Affect Oil Palm Fungal Diseases?"
[40] Comte et al., "Agricultural Practices in Oil Palm Plantations and Their Impact on Hydrological Changes, Nutrient Fluxes and Water Quality in Indonesia. A Review."
[41] Ibid.
[42] Moll, *The Economics of Oil Palm*.
[43] Ng et al., "Ergonomics Observation: Harvesting Tasks at Oil Palm Plantation."

fertiliser on the plantation or an additional energy source through methane capture. The CPO is then trucked from the mill to a refinery for further processing to RPO or a port for direct export.

Figure 7: Map of oil palm planted area by province in 2013. (Source: data from Republic of Indonesia Ministry and Agriculture)[44]



2.1 The Indonesian Palm Oil Industry

The expansion of Indonesian oil palm cultivation saw a 20-fold increase between 1967 and 1997, from 106,000 ha to 2.5 mha.[45] Oil palm plantations grew annually at about 110,000 ha between the years of 2005 to 2010, and the current planted area in Indonesia covers approximately 10.4 mha[46], compared to 5.4 mha in Malaysia.[47]

Before the spike in palm oil prices in 1974, large companies owned the majority of palm oil production; however, after 1974 the Indonesian government established the Nucleus Estate Scheme (NES) requiring a portion of a company's designated land area to be given to small farmers to manage, and would serve as the precursor for plasma gardens and plots.[48] Plasma farms have been part of a decentralisation effort and are separated from the core of the plantation, which is owned and managed by the company itself. Expansion of oil palm areas was often a result of aggressive rural development and resettlement schemes.[49] Often these schemes were not solely a means of dealing with unemployment but also a way of infiltrating rural uprisings by planting peasants more loyal to the government.[50] By 1990, Indonesia was one of the few countries still practising active resettlement.[51]

[44] Republic of Indonesia Ministry of Agriculture, "Agricultural Statistics Database."
[45] Casson, "The Hesitant Boom: Indonesia's Oil Palm Sub-Sector in an Era of Economic Crisis and Political Change."
[46] Sumarga and Hein, "Mapping Ecosystem Services for Land Use Planning, the Case of Central Kalimantan."
[47] MPOB, "Area Statistics, Economics and Development Division, Malaysian Palm Oil Board, Kuala Lumpur."
[48] Bangun, "Presented at the National Institute of Oilseed Products Annual Convention, Phoenix, Arizona, March 21-25."
[49] Pletcher, "Regulation with Growth: The Political Economy of Palm Oil in Malaysia"; Fold, "Oiling the Palms: Restructuring of Settlement Schemes in Malaysia and the New International Trade Regulations"; Johnson, "Tree Crops and Tropical Development: The Oil Palm as a Successful Example"; Sutton, "Agribusiness on a Grand scale–FELDA's Sahabat Complex in East Malaysia."
[50] Uhlig, "Spontaneous and Planned Settlement in Southeast Asia."
[51] Rudel, "Changing Agents of Deforestation: From State-Initiated to Enterprise Driven Processes, 1970–2000."

Nine companies control over 20% of Indonesia's oil palm area and produce 35% of CPO.[52] Large conglomerates (including those top nine) make up 40% of total production area, medium-sized companies make up 41%, smallholders 12% (<50 ha), and the state 7%.[53] The size of the average private and state-owned oil palm enterprise is around 3,000-20,000 ha, while smallholdings are generally less than 50 ha and on average only 2 ha.[54] The smallholder sector remains the fastest growing in Indonesia, with currently 28% formally affiliated with a conglomerate and 72% remaining independent.[55]

The yield gap between private enterprises and smallholders is large, with national averages of 3.9 t CPO/ha and 3.4 t CPO/ha[56] respectively, both significantly below Malaysia's average of 4.5 t CPO/ha (see Figure 5).[57] The literature states that potential yields could reach from 10-11 t /ha (more realistic) to as much as 18 t/ha.[58] This yield gap may be due to poor reporting, under investment in soil management and fertiliser application, or because current profit margins are adequate and do not encourage the attainment of higher yields.[59] Theoretically, increasing yields on existing planted areas could reduce the pressure of expanding into forest; some efforts have estimated that increasing yields of both independent and the supported plasma smallholders could save between 232,000 and 473,000 ha of forest in Central Kalimantan from conversion.[60] That said, greater per-hectare returns could also serve as a perverse incentive to convert more areas to productive oil palm cultivation, as shown in other contexts where intensification did not lead to land sparing.[61]

Although initial planting took place primarily on Sumatra's more fertile soils,[62] the Indonesian government has since shifted expansion to areas of Kalimantan and Irian Jaya (Papua)[63] (Figure 5). Most suitable concessions in Kalimantan and Sumatra have already been issued, making Papua a prime target for future Indonesian oil palm expansion.[64] The Indonesian oil palm industry has faced considerable criticisms concerning the destruction of charismatic species' habitat (e.g. Sumatran tiger, Orang-utan, and Sumatran rhino), carbon emissions from cultivating peatland, and health problems associated with regional haze from rampant forest fires. These will be explored in more detail in the following section.

[52] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[53] Ibid.
[54] Comte et al., "Agricultural Practices in Oil Palm Plantations and Their Impact on Hydrological Changes, Nutrient Fluxes and Water Quality in Indonesia. A Review."
[55] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[56] Directorate General of Estates, Department of Agriculture, 2010
[57] Sayer et al., "Oil Palm Expansion Transforms Tropical Landscapes and Livelihoods."
[58] Ibid.
[59] Comte et al., "Agricultural Practices in Oil Palm Plantations and Their Impact on Hydrological Changes, Nutrient Fluxes and Water Quality in Indonesia. A Review."
[60] Boer et al., "Reducing Agricultural Expansion into Forests in Central Kalimantan-Indonesia: Analysis of Implementation and Financing Gaps."
[61] Ceddia et al., "Governance, Agricultural Intensification, and Land Sparing in Tropical South America"; Barretto et al., "Agricultural Intensification in Brazil and Its Effects on Land-use Patterns: An Analysis of the 1975–2006 Period"; Gutiérrez-Vélez et al., "High-Yield Oil Palm Expansion Spares Land at the Expense of Forests in the Peruvian Amazon."
[62] Corley, "How Much Palm Oil Do We Need?"
[63] Casson, "The Hesitant Boom: Indonesia's Oil Palm Sub-Sector in an Era of Economic Crisis and Political Change."
[64] Obidzinski, Dermawan, and Hadianto, "Oil Palm Plantation Investments in Indonesia's Forest Frontiers: Limited Economic Multipliers and Uncertain Benefits for Local Communities."

3 Environment-related risks in the palm oil value chain

Following the framework set out by Caldecott et al. (2013),[65] we have conducted an initial literature-based assessment of environment-related risk factors that could impact financial, human, natural, physical, and social assets along the Indonesia palm oil value chain. We have sought to understand the materiality of these risk factors, in terms of likelihood, timing, and potential scale of impact.

The risks we consider are split into two groups, physical or economic. They include: land degradation and declining ecosystem services; fire and air pollution; weather variability and climate change; GHG targets and regulations; biofuel policies; land use regulations; and pressures from sustainable development and green industry paradigms. Assets associated with the palm oil value chain (see Figure 7) are affected in different ways and to different extents by these drivers.

Natural assets include the farmland itself, water resources, biodiversity, and general ecosystem service. Physical assets refer to the plantation crops, infrastructure, and other processing facilities. Financial assets include investments and financial derivatives of the commodity. Human assets refer to the knowledge and expertise around agricultural technologies and management practices and experience. Finally, social assets cover policy, business, consumer, and community networks that hold sway in the licence to operate for the palm oil industry.

Figure 7: Asset stranding risk framework by asset category. From Caldecott, et al. (2013)[66]

3.1 Methods

The following section is broken down by risk factor and the potential impacts on different asset types discussed. For each risk, we have evaluated the level of vulnerability using an environmental risk assessment and management framework[67] and a traffic light rating system (see Table 6). This environmental

[65] Caldecott, Howarth, and McSharry, "Stranded Assets in Agriculture : Protecting Value from Environment-Related Risks."
[66] Ibid.
[67] e.g. Gormley et al., "Guidelines for Environmental Risk Assessment and Management. Green Leaves III."

risk assessment and management framework outlines a process: first identifying a hazard or harm to the system (here presented as drivers), estimating the potential consequences and probability of impact, and then a judgment made on the significance of the risk. It is advised that both positive and negative effects are acknowledged, and similarly to the previous discussion of drivers of stranded assets, this guide argues for consideration of technical and economic factors, environmental security, social issues, and organisational capabilities.

Table 6: Risk Assessment Traffic Light Matrix (adapted from Gormley, et al. 2011)[68]

Likelihood/Consequences	Catastrophic	Major	Minor	Negligible
Almost Certain				
Likely				
Possible				
Unlikely				

In the context of oil palm, sensitivity to each environment-related risk ranges from red (high vulnerability) to green (low vulnerability). This is a product of the likelihood of an event happening and the severity of the consequences, determined by considering probability of occurrence within the next 30 years (based on the planting cycle of oil palm plantations) and what proportion of the sector could be impacted. These are our initial subjective assessments based on literature reviews and should be treated as such.

Table 7 provides a summary of our assessments. Future analysis could attempt to quantify probability and severity with more specificity and certainty.

Table 7: Summary of Physical and Economic Risks

Key: +3 +2 +1 +0	Physical Assets	Social Assets	Financial Assets	Human Assets	Natural Assets	Combined (/15)
Land degradation, deforestation, or habitat loss	+2	+2	+1	+1	+3	9
Fire and Air Pollution/Haze	+2	+1	+1	+3	+3	10
Weather Variability and Climate Change	+2	+2	+2	+2	+1	9
Greenhouse Gas Regulations	+2	+1	+1	+1	+0	5
Emergent biofuel policies	+0	+1	+0	+2	+3	6
Land use policy	+2	+3	+3	+2	+2	12
Reputational risks	+2	+2	+2	+2	+1	9
TOTAL (/21):	**12**	**12**	**9**	**13**	**13**	

[68] Ibid.

3.2 Physical Drivers

3.2.1 Land Degradation, Deforestation, and Habitat Loss

The erosion of land quality and the loss of forested land and habitat are serious risks in the palm oil supply chain, and ones that have been gaining attention in recent years. As discussed previously, oil palm is one of three sectors (the others being timber and mining) driving significant deforestation in Indonesia, particularly in peatland areas. Establishment of palm oil plantations is estimated to be responsible for around 16% of recent deforestation.[69] Furthermore, additional loss of forest could continue, as an additional planted area of 12 million ha is projected in order to meet the anticipated demand for palm oil as a food product.[70] Because of the attention given at an international level and the influence of conservation networks on civil society awareness, biodiversity loss from habitat destruction also heightens the risks facing palm oil companies' reputations.

Much of the international scrutiny of the Indonesian palm oil sector by environmental NGOs has historically focused on the high rate of biodiversity loss caused by poorly coordinated conversion of primary forest to oil palm plantations (though carbon emissions have recently become prominent and are discussed later). Indonesia is home to the third largest area of tropical forest (after the Amazon and Congo Basins) and is a global biodiversity hotspot with high rates of endemism.[71] Species richness decreases for most taxa when forest is converted to oil palm plantation;[72] therefore huge amounts of biodiversity in Indonesia will be lost as expansion of oil palm continues at current rates.[73] Moreover, because plantation is often uninhabitable for forest species, fragmented forest may be isolated in a matrix of palm plantation, effectively barring any movement of wildlife between patches.[74]

Compared with other vegetable oil feedstocks, Indonesian oil palm has a very low water stress index;[75] however, producing CPO is incredibly water intensive. For every 1 t CPO produced 5 to 7.5 tonnes of water is necessary and for 1 t FFB processed 0.75 t POME is produced.[76] Streams in close proximity to large-scale oil palm plantations are influenced by this water use, and exhibit greater sediment loads and elevated temperatures, impacting the productivity of aquatic systems.[77] Local communities have complained that non-compliant companies pollute waterways by illegally dumping raw POME, and that during dry seasons they have trouble getting adequate water from their wells.[78] They have also noted changes in fish size and an increase in the number of dead fish they catch.[79]

In Indonesia, just three provinces account for nearly 3.8 mha of remaining peat swamp forests, namely: Riau, Central, and Western Kalimantan.[80] Conversion of peatland poses an additional problem for both loss of environmental functions and services and the viability of current plantation land. Intact peatlands are a

[69] Fitzherbert et al., "How Will Oil Palm Expansion Affect Biodiversity?"
[70] Corley, "How Much Palm Oil Do We Need?"
[71] Myers et al., "Biodiversity Hotspots for Conservation Priorities."
[72] Foster et al., "Establishing the Evidence Base for Maintaining Biodiversity and Ecosystem Function in the Oil Palm Landscapes of South East Asia."
[73] Wilcove et al., "Navjot's Nightmare Revisited: Logging, Agriculture, and Biodiversity in Southeast Asia."
[74] Fitzherbert et al., "How Will Oil Palm Expansion Affect Biodiversity?"
[75] Jefferies et al., "Water Footprint and Life Cycle Assessment as Approaches to Assess Potential Impacts of Products on Water Consumption. Key Learning Points from Pilot Studies on Tea and Margarine."
[76] Mukherjee and Sovacool, "Palm Oil-Based Biofuels and Sustainability in Southeast Asia: A Review of Indonesia, Malaysia, and Thailand."
[77] Carlson et al., "Influence of Watershed-climate Interactions on Stream Temperature, Sediment Yield, and Metabolism along a Land Use Intensity Gradient in Indonesian Borneo."
[78] Larsen et al., "Towards 'hybrid Accountability'in EU Biofuels Policy? Community Grievances and Competing Water Claims in the Central Kalimantan Oil Palm Sector"; Orsato, Clegg, and Falcão, "The Political Ecology of Palm Oil Production."
[79] Larsen et al., "Towards 'hybrid Accountability'in EU Biofuels Policy? Community Grievances and Competing Water Claims in the Central Kalimantan Oil Palm Sector."
[80] Koh et al., "Remotely Sensed Evidence of Tropical Peatland Conversion to Oil Palm."

valuable ecosystem for regulating drought and floods, in addition to storing carbon. For example, during periods of heavy rainfall, excess water can be captured and then slowly released during drier periods of the year, providing water regulatory services.[81] There is also more recent evidence that conversion of peatland leads to subsidence, and can therefore endanger current plantations and infrastructure. Flooding on plantations, as a consequence of land subsidence, has already been shown to be a significant risk in peatland areas.[82] The occurrence of such floods on a plantation can delay harvesting of FFB and thereby affect the quality of mill CPO.[83] Loss of peatlands contributes to biodiversity declines, with a recent study demonstrating negative impacts on 16 species in Sumatra.[84] Although peatland is more expensive to convert to oil palm plantation, as land becomes scarcer and demand remains high, additional pressure on these areas could develop.

Indonesia is currently making an effort to combat its annual deforestation rate. According to former President Yudhoyono, deforestation rates dropped from 1.2 mha between 2003 and 2006 to 0.45-0.6 mha from 2011 to 2013.[85] At the most recent COP in Paris, Indonesia has committed to decrease GHG emissions by 29% by 2030 or a 41% reduction if they receive international support.[86] Unfortunately, their submitted Intended Nationally Determined Contribution (INDC) does not report their assumed business as usual (BAU) baseline emissions.[87]

Figure 8: Assets at risk from land degradation, deforestation, or habitat loss

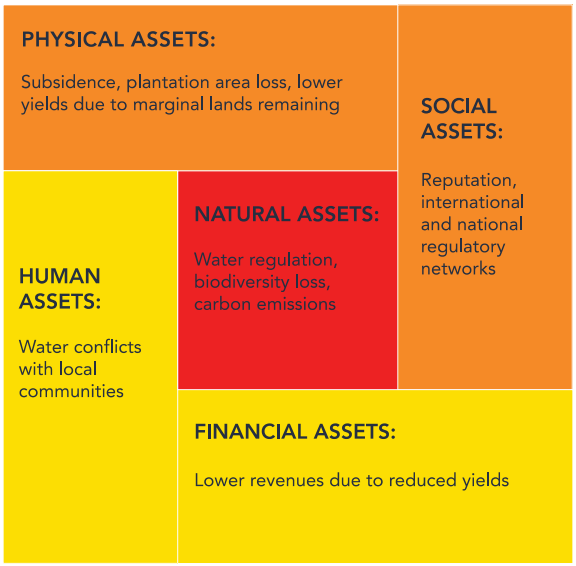


Figure 8 presents our initial assessment of the risks associated with land degradation, deforestation, and habitat loss. It considers the impact on natural assets from conversion of forest to oil palm plantation to be major or almost certain, due to inevitable impacts on local water sources, carbon emissions from replacement of forest or peatland, and loss of biodiversity from habitat destruction. Social and physical assets are expected to face moderate levels of vulnerability, due to probable major impacts from poorly regulated conversion of valuable forest or peatland or diminishing quality of remaining land to cultivate and eventual loss of currently cultivated peatland areas to subsidence. Human assets, particularly

[81] Comte et al., "Agricultural Practices in Oil Palm Plantations and Their Impact on Hydrological Changes, Nutrient Fluxes and Water Quality in Indonesia. A Review."
[82] Hooijer et al., "Flooding Projections from Elevation and Subsidence Models for Oil Palm Plantations in the Rajang Delta Peatlands, Sarawak, Malaysia."
[83] Wen and Sidik, "Impacts of Rainfall, Temperature and Recent El Niños on Fisheries and Agricultural Products in the West Coast of Sabah."
[84] Koh et al., "Remotely Sensed Evidence of Tropical Peatland Conversion to Oil Palm."
[85] Satriastanti, "Will Indonesia's next President Maintain Its Climate Commitments?"
[86] The Ministry of Environment and Forestry – Republic of Indonesia, "Intended Nationally Determined Contribution."
[87] Fransen, "Indonesia's Draft Climate Plan (INDC): A Good State, But Improvements Necessary for Success."

relationships with local communities, are likely to be affected due to impacts on local water supplies. Finally, there is a possibility that revenues may suffer a reduction due to yield losses from planting on marginal soils, but the severity and extent are still unclear.

3.2.2 Fire and Air Pollution

Fire has been an integral part of land preparation, used to clear land of forest and drained peat, although illegal apart from for small local farmers.[88] The intensity and scale of fires have increased in Indonesia, most of which appear to occur on Sumatra, in Jambi and Riau provinces, and Borneo.[89] Autumn 2015 saw an unusually high level of fire outbreaks, exceeding the crisis levels of 2013 and 2014 and setting a record daily peak on September 8th 2015.[90] Regional haze from forest fires was already a serious problem in Southeast Asia, and led ASEAN to establish a Regional Haze Action Plan (RHAP) and Agreement on Transboundary Haze Pollution (AATHP). The treaty was signed in 2002 and ratified in 2003 by all member countries except for Indonesia.[91]

In Indonesia, a state of emergency was declared in the Riau Province during the September 2015 fire outbreaks, and even more fires and similar levels of haze were found in other provinces.[92] Public attention worldwide around these events is creating more pressure for action by government agencies and private companies, and prompted Indonesia to sign on to the AATHP in January 2015.[93] Considering the effects of fire transcend national borders, and are felt acutely by six countries in the region, there could be additional diplomatic consequences with further inaction.

During El Niño years (e.g. 1982, 1997, 2006 and 2009) drought conditions are more prevalent, and fires and haze usually worsen accordingly. However, following decades of forest and peatland degradation, rampant fires are now occurring even during non-drought years.[94] The haze related to these fires can have significant effect on the health of residents in Southeast Asia.[95] Particularly bad years, such as during the El Niño in the late 1990's, saw over a tenth of the region's 450 million people exposed to unsafe levels of particulate air pollution,[96] and resulted in an estimated cost of between US$2.3-3.5 billion.[97] According to a 2015 report, over 100,000 deaths annually in Southeast Asia are due to particulate air pollution from forest and peat fires, largely due to land clearing practices.[98] In terms of physical assets, smallholders and companies alike can lose plantations and infrastructure due to fire.[99] In years of particularly rampant fires, the expansion of oil palm plantations at the national level slowed by over 3%.[100]

A newer field of atmospheric science has been exploring the impact of isoprene, a volatile organic compound (VOC) emitted by vegetation, which can react with local pollution to form ozone.[101] Oil palm emits ten times more isoprene than Southeast Asian forests, which are generally lower emitters than other

[88] Minnemeyer, Samadhi, and Sizer, "Land and Forest Fires in Indonesia Reach Crisis Levels."; Burning to clear land is prohibited under Law No. 32/2009 on the Protection and Management of Environment and Government Regulation No. 4/2001 on Management of Environmental Degradation and/or Pollution linked to Forest or Land Fires.
[89] Forsyth, "Public Concerns about Transboundary Haze: A Comparison of Indonesia, Singapore, and Malaysia."
[90] Minnemeyer, Samadhi, and Sizer, "Land and Forest Fires in Indonesia Reach Crisis Levels."
[91] Forsyth, "Public Concerns about Transboundary Haze: A Comparison of Indonesia, Singapore, and Malaysia."
[92] Minnemeyer, Samadhi, and Sizer, "Land and Forest Fires in Indonesia Reach Crisis Levels."
[93] ASEAN, "Indonesia Deposits Instrument of Ratification of the ASEAN Agreement on Transboundary Haze Pollution."
[94] Gaveau et al., "Major Atmospheric Emissions from Peat Fires in Southeast Asia during Non-Drought Years: Evidence from the 2013 Sumatran Fires."
[95] Varkkey, *The Haze Problem in Southeast Asia: Palm Oil and Patronage*.
[96] Goodman and Mulik, "Clearing the Air: Palm Oil, Peat Destruction, and Air Pollution."
[97] Wakker, "Greasy Palms. The Social and Ecological Impacts of Large-Scale Oil Palm Plantation Development in Southeast Asia."
[98] Goodman and Mulik, "Clearing the Air: Palm Oil, Peat Destruction, and Air Pollution."
[99] Ives, "The Choking Problem of Asia's Air Pollution."
[100] Shi, Sasai, and Yamaguchi, "Spatio-Temporal Evaluation of Carbon Emissions from Biomass Burning in Southeast Asia during the Period 2001–2010."
[101] Stavrakou et al., "Isoprene Emissions over Asia 1979–2012: Impact of Climate and Land-Use Changes."

tropical forests.[102] Stavrakou, et al. (2014) looked at historical emissions of isoprene and found their concentrations depended upon variations in temperature, solar radiation, and soil moisture, and they increased in response to the gradual rise in Asian temperatures (e.g. 0.24°C per decade) (see Figure 9). Simulations looking at isoprene impacts of significant increases in oil palm areas estimated increases in mean annual ozone of 11% or monthly means increasing by 25% for Southeast Asia.[103] While the extent of impact still needs to be quantified, elevated local ozone levels can have negative consequences for human health and crop productivity.

Figure 9: Historic changes in relevant climatic/atmospheric related variables. (Source: Stavrakou, et al. 2014)[104]

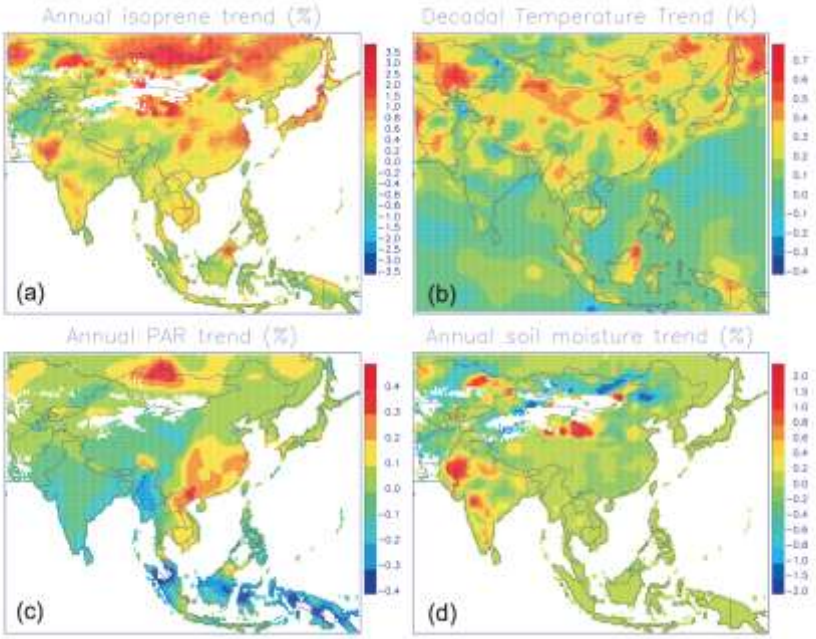
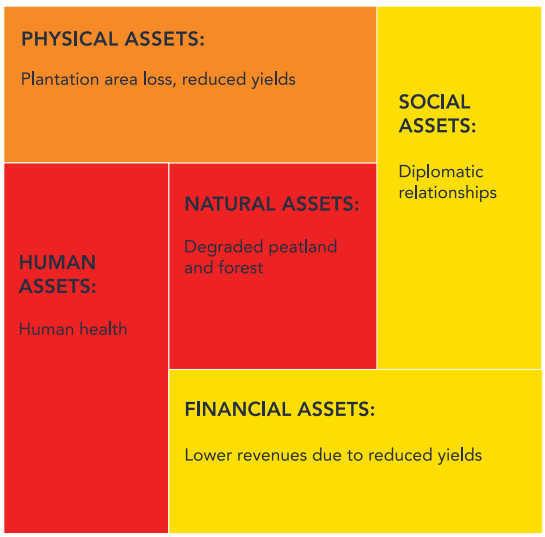


Figure 10: Assets at risk from fire and air pollution/haze



[102] Ibid.
[103] Ashworth et al., "Impacts of near-Future Cultivation of Biofuel Feedstocks on Atmospheric Composition and Local Air Quality."
[104] Stavrakou et al., "Isoprene Emissions over Asia 1979–2012: Impact of Climate and Land-Use Changes."

Figure 10 presents our initial assessment of the risks from fire and air pollution. It shows the most highly vulnerable assets are natural and human. Cleared peatlands and degraded forests are natural assets prone to ignition and loss due to fires. Occurring even during seasonal dry spells non-drought years (observed back to 2005),[105] fires are considered to have a highly likely and major impact on natural assets. Fires and resulting haze are also expected to become more common,[106] making the likelihood and level of impact on human health high. The risks to physical assets, though not as significant as for natural and human assets, will likely include slower expansion during periods of high haze and fire. Social assets, particularly diplomatic relationships with the Southeast Asian region, could be strained further, though may be mitigated by the Indonesian government taking action to address the fires. Finally, there is a possibility of reduced yields due to lower solar radiation, resulting in less revenue for plantations.

3.2.3 Weather Variability and Climate Change

Studies on palm oil and climate change focus primarily on the commodity as a source of greenhouse gas emissions from operations and forest conversion. However, the viability of the crop will also face challenges from climatic changes. Although oil palm is the highest yielding oil crop, there are still many factors that can impact its productivity. Solar radiation is the primary factor determining oil palm's maximum potential yield, followed by soil fertility, precipitation, and temperature.[107] The Intergovernmental Panel on Climate Change (IPCC) anticipates that temperatures in Southeast Asia will rise between 2° and 6°C by mid-century (based on the Coupled Model Intercomparison Project Phase 5 (CMIP5) simulations under all four Representative Concentration Pathway (RCP) scenarios), and expects that seasonal precipitation and monsoonal extremes will become more pronounced (e.g. rainier rainy seasons).[108] In Indonesia, increased drought is linked to fires, and the IPCC also suggests that feedback loops from burning biomass and peatland as mentioned in the previous section could reduce rainfall further and stimulate additional fires.

Oil palm productivity declines at temperatures above 35°C, and thus climate change related temperature increases would likely have negative impacts on oil palm yields. In general, higher temperatures correlate with higher production of leaves by individual palms, creating a positive relationship between temperature and FFB production up to at least a maximum temperature of 32°C.[109] However, there is some evidence that an increase in mean annual temperatures of 24°C to 27°C could reduce FFB yields by 1.1 t FFB/ yr, most likely due to increased respiration stress.[110] Southeast Asia is projected to have among the highest temperature increases globally,[111] although it is unclear how this would impact the region's oil palm yields without considering changes in the other main climatic influences.[112]

The impact of rainfall on FFB yield has been the most studied, particularly the importance of rain events during important growth events in a palm's life cycle.[113] Climatic events up to 24 months before fruiting can impact the productivity of a palm. For instance, flower sex is determined two years in advance; if there is any water stress during this time, more male flowers may be produced resulting in lower fruit production. If trees are under stress 18 months before fruit production, inflorescence abortion occurs and affects female flowers. Finally, pollination of flowers occurs five months before the fruit matures. If there is heavy rain during this period, lower fruit set can occur, causing reduced bunch weight.[114]

[105] Gaveau et al., "Major Atmospheric Emissions from Peat Fires in Southeast Asia during Non-Drought Years: Evidence from the 2013 Sumatran Fires."
[106] Hijioka et al., "Asia."
[107] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."
[108] Hijioka et al., "Asia."
[109] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."; Wen and Sidik, "Impacts of Rainfall, Temperature and Recent El Niños on Fisheries and Agricultural Products in the West Coast of Sabah."
[110] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."
[111] Gopal, "Future of Wetlands in Tropical and Subtropical Asia, Especially in the Face of Climate Change."
[112] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."
[113] Ibid.
[114] Harun et al., "Impact of El Niño Occurrence on Oil Palm Yield in Malaysia."

Generally, yield effects are most visible two years after a drought period, indicating the biological process of flower formation is the most influential on yields.[115] Periodic climatic events like El Niños can reduce precipitation, causing water stress and creating conditions for forest fires. However, under climate change projections, precipitation is expected to increase over tropical Asia, most likely through more concentrated rain events.[116] A less even distribution of rainfall may create a similarly varied pattern of FFB productivity throughout the year.[117]

Shorter periods of intensified rainfall could also intensify flood risks, threatening plantations themselves and infrastructure.[118] A greater risk of flooding in lowland areas is further augmented by sea-level rise, which poses a very real threat particularly in the coastal ecosystems (such as mangroves) that have been degraded over the last century.[119] Predictions of sea level rise range between 9 and 88cm by 2100, with an average of 0.9 to 8.8mm per year.[120] Regions like Central Kalimantan, with peatland only a few metres above sea level could see this greater risk of flooding or saltwater intrusion,[121] especially if these areas were drained and subsidence of 5cm/yr is allowed to occur.[122] Saltwater intrusion would negatively affect the fertility of the soil and consequently the productivity of farmland.

The major fungal pests for oil palm are *Fusarium* wilt and *Ganoderma* rot.[123] *Fusarium* is found more commonly in West Africa, and can either lead to acute wilt and death or survival for a few years but with considerable stunting.[124] It can lie dormant in soils, but is currently not present in Southeast Asia due to careful quarantine practices.[125] On the other hand, *Ganoderma* is a problem in Southeast Asia.[126] Once a tree is diagnosed with *Ganoderma* it is generally too late to be treated. In addition, the rot can worsen if palms have been replanted in the same area over and over again for 50 years or more *and* can be exacerbated by a no-burn policy, where old palms are left to rot on the field.[127]

The rhinoceros beetle is another serious pest for oil palm, providing the necessary conditions for *Ganoderma* rot to infect through cuts in the palm tissue.[128] Frond cutting at harvesting can also introduce rot to a tree, therefore better management practices may entail avoiding creating large wounds as well as removing older trees that may be more susceptible to disease.[129] There is considerable uncertainty regarding projected virulence of these pests. *Ganoderma* appears to be more common inland, but has an inverse relationship to temperature increases, which are predicted with climate change. Already it has been neutralised in unshaded soils, which can reach temperatures of 40^{o}C, while shaded soils may only reach 32^{o}C.[130] However, surface soil temperatures above 45^{o}C can impact the palms ability to extract water and nutrients from the soil, slowing their growth.[131]

[115] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."
[116] Gopal, "Future of Wetlands in Tropical and Subtropical Asia, Especially in the Face of Climate Change."
[117] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."
[118] Measey, "Indonesia: A Vulnerable Country in the Face of Climate Change."
[119] Gopal, "Future of Wetlands in Tropical and Subtropical Asia, Especially in the Face of Climate Change."
[120] Ibid.
[121] Hooijer et al., "Flooding Projections from Elevation and Subsidence Models for Oil Palm Plantations in the Rajang Delta Peatlands, Sarawak, Malaysia."
[122] Sumarga and Hein, "Mapping Ecosystem Services for Land Use Planning, the Case of Central Kalimantan."
[123] Paterson, Sariah, and Lima, "How Will Climate Change Affect Oil Palm Fungal Diseases?"
[124] Ibid.
[125] Ibid.
[126] Ibid.
[127] Murphy, "Future Prospects for Oil Palm in the 21st Century: Biological and Related Challenges."
[128] Hushiarian, Yusof, and Dutse, "Detection and Control of Ganoderma Boninense: Strategies and Perspectives."
[129] Ibid.
[130] Paterson, Sariah, and Lima, "How Will Climate Change Affect Oil Palm Fungal Diseases?"
[131] Lim et al., "Paper Presented at the Seminar on Agronomic Principles and Practices off Oil Palm Cultivation, Sibu, Sarawak."

Figure 11: Assets at risk from increasing weather variability and climate change

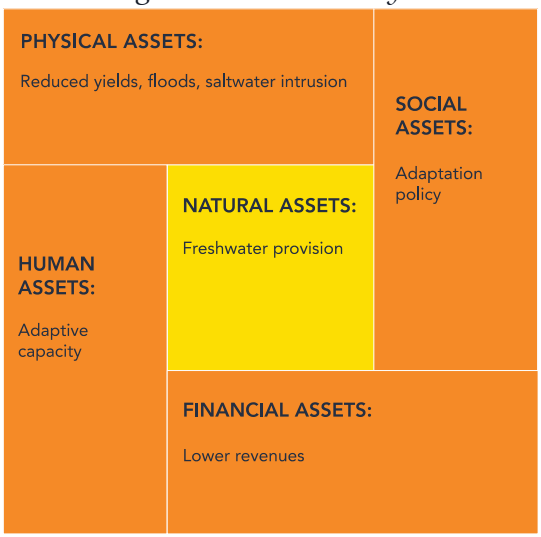


Figure 11 presents our initial assessment of weather variability and climate change. The impacts of climate change will affect the Indonesian palm oil industry, with increasing temperatures and punctuated rain events affecting palm oil productivity. Sea-level rise may impact lowland peatland areas in Sumatra and Kalimantan. Freshwater availability for palm oil plantations could also be affected, through saltwater intrusion, seawater flooding, and changing precipitation.

3.3 Economic Drivers

3.3.1 Greenhouse Gas Regulations

Including emissions from agriculture and land use, land use change, and forestry (LULUCF),[132] Indonesia is the world's fourth largest greenhouse gas emitting country. In 2009, at the Group of Twenty (G20) summit in Pittsburgh, former Indonesia's President Yudhoyono committed to reducing the country's emissions by 26% below 2020 BAU emissions. This would be roughly equivalent to 0.767 Gt CO_2e by 2020,[133] contrasting Indonesia's current estimated LULUCF emissions (e.g. deforestation and peatland drainage) at 1.0 Gt CO_2e/yr, roughly 80% of the country's total emissions.[134]

More recently, Indonesia submitted its INDC to the UNFCCC, committing to the same 26% by 2020 and a 29% reduction in emissions from the BAU scenario by 2030.[135] In 2009, the previous Indonesian government offered a conditional commitment of 41% by 2020 contingent on a global climate agreement, as well as assistance to cover technology, payment for performance mechanisms, and access to financial resources. It was estimated that an additional US$5.92 billion of international financing would be required. With a global climate agreement reached in Paris, the Indonesian government is beginning the process of revising their National Action Plan on reducing greenhouse gas emissions (RAN-GRK), although the final emissions reduction target remains unclear.[136]

[132] Excluding EU28 and EU15. CAIT Greenhouse Gas Emissions Explorer. World Resources Institute. http://www.wri.org/resources/data-sets/cait-country-greenhouse-gas-emissions-data
[133] Thamrin, "Paper Presented at the CCXG/Global Forum on Environment Seminar on MRV and Carbon Markets, Paris, 28-29 March 2011."
[134] California Environmental Associates, "A Review of Agricultural Emissions for the Climate and Land Use Alliance: Technical Annex to 'Strategies for Mitigating Climate Change in Agriculture: Recommendations for Philanthropy.'"
[135] The Ministry of Environment and Forestry – Republic of Indonesia, "Intended Nationally Determined Contribution"; Fransen, "Indonesia's Draft Climate Plan (INDC): A Good State, But Improvements Necessary for Success."
[136] Jong, "Indonesia Environment Ministry Says It's Time to Get down to Business."

According to Indonesia's INDC, 63% of greenhouse gas emissions come from land use change and peat fires, while only 19% are a product of fossil fuel combustion. Previous analyses of Indonesia's climate mitigation strategy have estimated that 85% of emission reductions would need to come from changes in land-use management.[137] The Indonesian INDC also acknowledges this, designating 12.7 million hectares of forest for social forestry, ecosystem restoration, conservation, and sustainable development.

These commitments require reversing a trend in land use change and forest degradation. Since the 1970s, the island of Borneo has already lost forest at a rate twice as fast as the rest of the world's tropical forest areas largely due to palm oil conversion.[138] Palm oil plantations store significantly less biomass than natural forest (either undisturbed or logged) with the net carbon lost depending on the type of land cover the plantation replaces.[139] Looking at the carbon footprint of the entire 12.4 mt CPO exported in 2007, Saikku et al[140] estimated that per ton emissions were closer to 10.5 t CO_2e per t CPO.

Once palm oil plantations have been established, management activities also cause significant GHG emissions, of which the largest volume is due to the application of fertilisers. These can account for between 3% and 19% of total emissions.[141] Shifting these practices would require additional input of knowledge and/or technology beyond the current management practice.

POME is another significant source of GHG emissions. It is highly acidic and contains large quantities of suspended solids that create significant biological and chemical activity.[142] It is illegal to dump POME directly into adjacent water bodies, therefore law-abiding companies allow the suspended solids in POME to be slowly decomposed through a series of open-air ponds. But in this way, significant CO_2 and CH_4 emissions are released to the atmosphere, equivalent to 15-35% of total palm oil emissions.[143] Current estimates of methane emissions across the region from POME have it equal to approximately 30% of Indonesia's fossil fuel emissions.[144] To ameliorate this source of carbon emissions, it is possible to capture the released CH_4 and utilise it for electricity generation. The current capture rate of POME methane by active operations is only about 10%[145]. This is mainly due to biomass (e.g. EFB and palm kernel shells) already being used for powering mills and the remote location of mills making it difficult to sell excess electricity to local power grids.[146]

For smallholder production systems, the main sources of emissions are land cover related (e.g. peatland emissions and previous land covers). They are obliged to sell their FFB to privately owned mills and therefore are not responsible for processing emissions. Comparing their relative contribution to deforestation emissions in Sumatra from 2000-2010, smallholders were found to be responsible for 11% of forest destruction (including mangrove, peatswamp and lowland forest), compared to 88% by large enterprises.[147] In addition, large-scale companies plant on 80% of cultivated peatland and 60% of oil palm areas on lowland forest, even though smallholder areas increased by 190% and private enterprises by 82%.

[137] Caldecott et al., "Indonesia-Norway REDD+ Partnership: Second Verification of Deliverables."
[138] Gaveau et al., "Four Decades of Forest Persistence, Clearance and Logging on Borneo."
[139] Hirano et al., "Carbon Dioxide Balance of a Tropical Peat Swamp Forest in Kalimantan, Indonesia"; Page et al., "A Record of Late Pleistocene and Holocene Carbon Accumulation and Climate Change from an Equatorial Peat Bog (Kalimantan, Indonesia): Implications for Past, Present and Future Carbon Dynamics"; Page, Rieley, and Banks, "Global and Regional Importance of the Tropical Peatland Carbon Pool."
[140] Saikku, Soimakallio, and Pingoud, "Attributing Land-Use Change Carbon Emissions to Exported Biomass."
[141] Bessou et al., "Pilot Application of PalmGHG, the Roundtable on Sustainable Palm Oil Greenhouse Gas Calculator for Oil Palm Products."
[142] Comte et al., "Agricultural Practices in Oil Palm Plantations and Their Impact on Hydrological Changes, Nutrient Fluxes and Water Quality in Indonesia. A Review."
[143] Bessou et al., "Pilot Application of PalmGHG, the Roundtable on Sustainable Palm Oil Greenhouse Gas Calculator for Oil Palm Products."
[144] Taylor et al., "Palm Oil Wastewater Methane Emissions and Bioenergy Potential."
[145] Pehnelt and Vietze, "Recalculating GHG Emissions Saving of Palm Oil Biodiesel."
[146] Taylor et al., "Palm Oil Wastewater Methane Emissions and Bioenergy Potential."
[147] Lee et al., "Environmental Impacts of Large-Scale Oil Palm Enterprises Exceed that of Smallholdings in Indonesia."

In terms of total forest loss in Sumatra, smallholders are only responsible for 2% and private companies for 17%.[148]

While the current carbon footprint of the Indonesian oil palm sector would be hard to change, except for extensive methane capture of POME, future expansion of oil palm could have dramatic ramifications for meeting the Indonesian carbon emission targets. Current annual emissions from Kalimantan and Sumatra are 0.139-0.165 Gt CO_2e yr^{-1} and 0.077-0.102 GtC yr^{-1}, respectively.[149] If areas designated for oil palm are cultivated under BAU projections to 2020, Kalimantan alone could see emissions of 0.44 Gt CO_2e yr^{-1} [150] (see Figure 12). The provincial government of Central Kalimantan has a target to increase the planted area from 1 mha to 3.6 mha by 2020.[151]

Figure 12: Existing planted areas and approved leases for oil palm and timber extraction.[152]

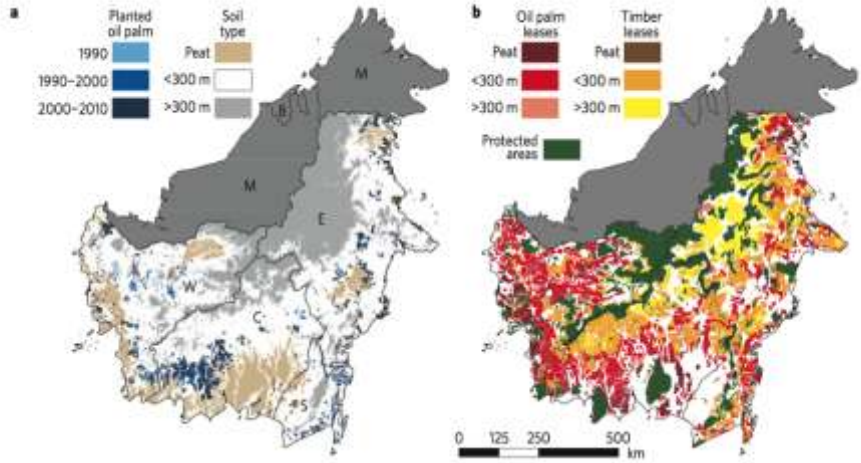
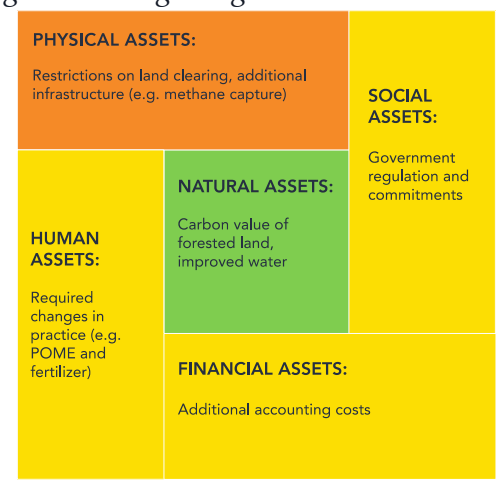


Figure 13: Assets at risk from greenhouse gas regulations



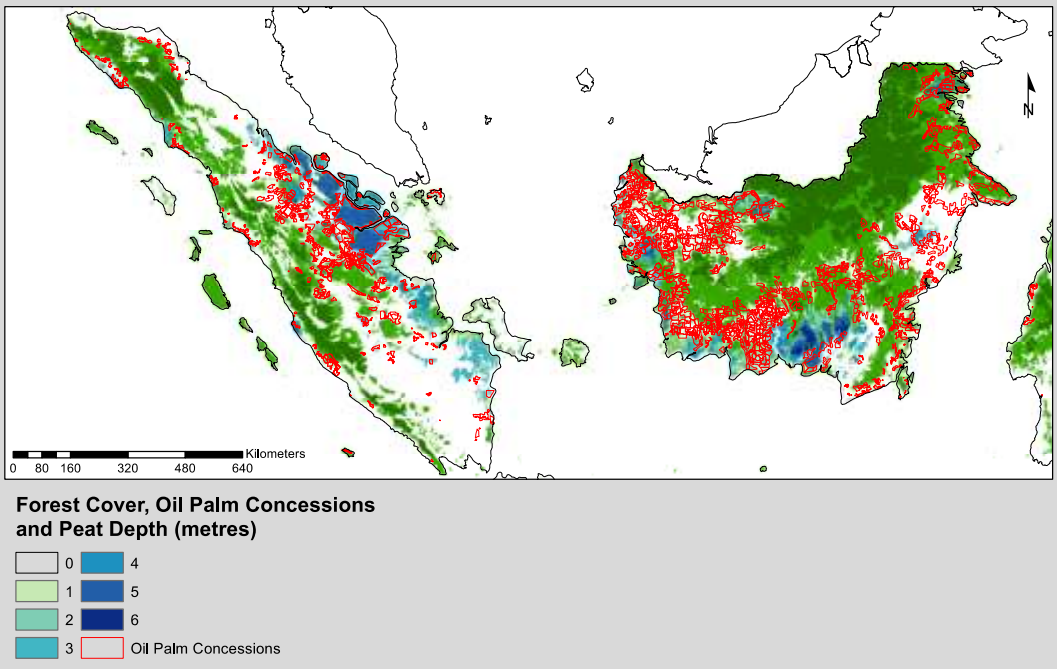
[148] Ibid.
[149] Carlson and Curran, "Refined Carbon Accounting for Oil Palm Agriculture: Disentangling Potential Contributions of Indirect Emissions and Smallholder Farmers."
[150] Ibid..
[151] Boer et al., "Reducing Agricultural Expansion into Forests in Central Kalimantan-Indonesia: Analysis of Implementation and Financing Gaps."
[152] Carlson et al., "Carbon Emissions from Forest Conversion by Kalimantan Oil Palm Plantations."

Figure 13 presents our initial assessment of the risk factors from greenhouse gas regulations. Physical assets face the possibility of major impacts, as existing forest concessions may be excised for conservation and/or additional infrastructure may be necessary if methane capture is required. The negative impacts on other assets, however, are minimal or even positive. Establishing the carbon value of remaining forest or peatland may actually improve natural assets, potentially improving yields. Also, with changes to management of POME, local water quality may be improved. New management processes to reduce GHG could improve mill efficiency and productivity and reduce fertilizer requirements, reducing costs.

Box 2: Peatland and Carbon Stocks

Cultivation of peatlands is a hugely controversial issue surrounding palm oil production. Tropical peatlands are highly acidified soils, which store immense amounts of carbon and organic matter under anaerobic (e.g. zero oxygen) conditions. Drainage of peatland exposes this organic matter to oxygen, thereby accelerating decomposition and carbon emissions. Southeast Asia is home to 56% of tropical peatlands,[153] constituting 2% of carbon stored in soils globally[154] and 20% of carbon found in peat soils worldwide.[155] Figure 13 shows the location of peatlands in Sumatra and Borneo as well as current forest area and formal oil palm concessions (both planted and planned). Although it is important to note that around 41% is considered shallow peat, which exhibits significantly lower emissions.[156]

Figure 14 Map of peatland area, forest cover and existing oil palm concessions[157]



[153] Hirano et al., "Carbon Dioxide Balance of a Tropical Peat Swamp Forest in Kalimantan, Indonesia."
[154] Sabine et al., "Current Status and Past Trends of the Global Carbon Cycle. In 'The Global Carbon Cycle: Integrating Humans, Climate, and the Natural world,.(Eds CB Field, MR Raupach) Pp. 17-44."
[155] Hooijer et al., "PEAT-CO2. Assessment of CO2 Emissions from Drained Peatlands in SE Asia,."
[156] Harun et al., "Impact of El Niño Occurrence on Oil Palm Yield in Malaysia."
[157] Indonesia Ministry of Forest, "Indonesia Oil Palm Concessions"; Wetlands International, "Interactive Atlas of Indonesia's Forests CD-ROM."

When cultivating this land cover after the initial carbon release of the forest clearance, drained peatland continues to emit carbon dioxide (CO_2) and methane (CH_4), which are both powerful GHGs.[158] These emissions are partially due to subsidence of the peat. In the case of deep peat, there is little firm land underneath the peat dome; therefore, as the peat depth slowly subsides so does the land area on which the oil palm trees are planted. Moreover, this phenomenon increases the already high risk of flooding in these lowland areas.[159] This effect has been measured in *Acacia* timber plantations where 124 cm of peat depth were lost over the first five years, slowing to 5 cm/yr afterwards. This would be similar for an oil palm plantation where Hergoualc'h and Verchot[160] estimated a 5.6 t CO_2/ha/yr increase in soil respiration with every 10 cm drop in water table. In addition, applying nitrogen mineral fertilisers to drained peatland increases emission by 4-10%.[161] All together cultivated peat emissions are equal to 7.7-11.5 t CO_2e /t CPO.[162]

3.3.2 *Biofuel Policies*

Biofuel policies and GHG regulations are inherently intertwined, and therefore the risks associated with oil palm as a biodiesel feedstock are also related to emissions. Many countries have biofuel targets, mandating bioethanol or biodiesel to comprise a certain percentage of blended ethanol or diesel. While rapeseed still dominates the biofuel market at 84%, palm oil is cheaper and represents an attractive alternative.[163]

Figure 15: Assets at risk from existing or emergent biofuel policies

While the energy conversion efficiency (i.e. ratio of available combustion energy in the biofuel relative to the fossil energy input for its production) for oil palm is 9:1, compared to 1.9-6 for soybeans and 1.8-4.4 for rapeseed,[164] the estimates of its carbon savings remain controversial because of significant palm oil

[158] Jauhiainen et al., "Carbon Fluxes from a Tropical Peat Swamp Forest Floor."
[159] Hooijer et al., "Flooding Projections from Elevation and Subsidence Models for Oil Palm Plantations in the Rajang Delta Peatlands, Sarawak, Malaysia."
[160] Harun et al., "Impact of El Niño Occurrence on Oil Palm Yield in Malaysia."
[161] Hergoualc'h and Verchot, "Greenhouse Gas Emission Factors for Land Use and Land-Use Change in Southeast Asian Peatlands."
[162] Reijnders and Huijbregts, "Palm Oil and the Emission of Carbon-Based Greenhouse Gases."
[163] Tan et al., "Palm Oil: Addressing Issues and towards Sustainable Development."
[164] Groom, Gray, and Townsend, "Biofuels and Biodiversity: Principles for Creating Better Policies for Biofuel Production."

emissions associated with LULUCF (as suggested in previous sections).[165] As a consequence, with more stringent accounting, Indonesian palm oil biodiesel may be prevented from being used to meet blending mandates. Palm oil biodiesel currently accounts for approximately 14% of biodiesel produced globally[166]. Biodiesel blending mandates (see Table 1) provide demand for palm oil and if this source of demand (or anticipated future demand) should fall this could reduce the price of palm oil and impact the cash flows of palm oil assets. Figure presents our initial assessment of the risk factors from biofuel policies. Because of the likely and major impacts associated with indirect land use change causing deforestation and biodiversity loss, stimulated by increased biofuel demand, natural assets are considered highly vulnerable. Related to increased demand, land clearance and burning practices discussed earlier could result in a possibility of major impact on human asset of health with rising isoprene levels. The risks to social assets are considered to be similar as with greenhouse gas regulations. Financial assets may get a marginally improve due to greater market access for palm oil. No changes to physical assets were identified.

3.3.3 Land Use and Patronage Policies

How land use and ownership rights are distributed and enforced is a particularly salient issue in Indonesia, and one that has considerable potential to strand assets in the palm oil supply chain. While complex, inconsistent, and potentially corrupt land use policies could lead to unplanned forest conversion and associated loss of ecosystem services and biodiversity, there are other risks to physical assets (e.g. land being revoked), foreign investors who may face barriers and delays, and the inciting of conflicts.

The land distribution and permitting system in Indonesia dates to the Suharto regime, during which the president cemented the loyalty of his political allies by issuing them forest concessions, preferring forest resource use for industrial purposes rather than subsistence or indigenous claims.[167] Following the removal of Suharto, the country began the process of government decentralisation, including the monitoring and management of forest resources.[168] One manifestation of this entrenched patronage system is former government bureaucrats ending up on plantation company advisory boards.[169]

With decentralisation and greater power at the local level came less financial support from the federal government; as a result, more revenues needed to be raised locally. This resulted in the prioritisation of development needs over forest conservation or local community interests.[170] The consequence has been uncoordinated forest clearance without adequate planning for biodiversity corridors or respect for previous land claims. Indonesia's current president, Joko Widodo, has stated that he intends to overhaul the currently decentralised and complex land acquisition process by applying fiscal pressure on provincial authorities. In addition, there are indications that this dynamic in the judicial system may be changing as well. For one, the Indonesian Constitutional Court (ICC) ruled in May 2013 that the Ministry of Forestry's wholesale claiming of forest as state-owned land, regardless of customary claims, was illegal. Although it is unclear as yet what the change in government policy will be to remedy this.[171]

There is also a large discrepancy in actual planted area relative to the number of permits issued for palm oil concessions. Indonesia's complex land purchase and concession issuance procedures facilitate this phenomenon. According to the National Land Authority (NLA), Indonesia's land policy is defined by 585 legal documents ranging from laws, government regulations, presidential decrees, circular letters, and ministerial instructions.[172] Since 1983, the Department of Forestry has been classifying all Indonesian

[165] Pimentel et al., "Food versus Biofuels: Environmental and Economic Costs."
[166] Ren, "Renewables 2015 Global Status Report."
[167] Harwell, "Without Remedy: Human Rights Abuse and Indonesia's Pulp and Paper Industry."
[168] Sumarga and Hein, "Mapping Ecosystem Services for Land Use Planning, the Case of Central Kalimantan."
[169] Varkkey, "Patronage Politics, Plantation Fires and Transboundary Haze."
[170] Irawan and Tacconi, "Reducing Emissions from Deforestation and Forest Degradation (REDD) and Decentralized Forest Management."
[171] IPAC, "Indigenous Rights Vs. Agrarian Reform in Indonesia: A Case Study from Jambi."
[172] Winoto, "Paper Presented at the Workshop In International Federation of Surveyors` Forum, Washington DC, March 2009."

forestlands using the TGHK (*Tata Guna Hutan Kesepakatan*), which classes forest into the following functional categories: protection forest, conservation forest, production forest, and conversion forest. Then with the Spatial Management Act of 1992, the RTRWP (*Rencana Tata Ruang Wilayah Propinsi*) or the provincial government spatial management plan allowed for classification of forest areas into protection forest, forestland for cultivation, and non-forest cultivation area. These two systems have been integrated since 1993.[173] A forest concession right, HPH (*Hak Pengusahaan Hutan*), can be issued for forests classified for conversion or production. For a timber plantation specifically, an HTI (*Hutan Tanaman Industri*) must be issued. While the HPH system was designed to monitor and control the negative environmental impacts of forest extraction, due to licences being handed out as political favours it has been as a major driver of forest degradation.[174]

To establish an oil palm plantation it is necessary to acquire three permits. The first, *Ijin prinsip*, is issued by the *bupati* (or local authority), which recognises the company's operation. Then follows the *Ijin lokasi*, which establishes the location where the company can operate and allows for the initial siting of nurseries. Then the *Ijin usaha perkebunan* allows the company to start planting oil palms and begin production. Once the third permit is awarded, the company must then get the final concession permit from the National Land Agency, or HGU (*Hak Guna Usaha*), which is only possible if the Ministry of Forestry has released the area from a forest classification. Unfortunately, some opportunistic actors have used this process of acquiring an HGU solely perform timber extraction rather than plant oil palm. It is estimated that only 1 mha of 5.3 mha designated for oil palm has actually been planted.[175]

A legacy of the Suharto era, the issuing of permits has also led to tensions over use and access rights, as well as contested claims of ownership. One legacy of this is formal and informal land tenure conflicts. In 2007, the latest year where data were available, over 7,491 formal land tenure conflicts were being processed in Indonesian courts.[176] In 2009, 7.3 mha of land were believed to be abandoned or idle due to discrepancies in land ownership.[177] Plantation-related social conflicts comprise at least a third of all conflicts related to forest and land in the country, 50% of which required military involvement.[178]The main institutions for resolving these conflicts have been the land dispute settlement operation (*Operasi Tuntas Sengketa*) and land dispute investigation operation (*Operasi Sidik Sengketa*), which have resolved 1,778 of the above cases.[179]

Permits for palm oil concessions from local authorities may be revoked if there has been severe mismanagement by the company, no HGU issued before operations commenced, and/or lack of action by the company within two years of receiving the permit to establish a plantation.[180] One indication that more accountability and streamlining may be entering the forestry licensing process is the recent transition to an online system in September 2013.[181] Only six of the 12 permits are currently issued online, restricted to licenses for utilization of forest products, conversion of land, non-mining forest use, and surveys/exploration. Establishing this system falls under the mandate of the Ministry of Forestry reform, and is a process that could potentially incorporate new oil palm concessions, allowing for consolidation of information and improving the transparency and oversight of forest conversion.

Not surprisingly, foreign investors have complained to the president's office regarding the difficulty of acquiring and operating land. The cost of establishing a 1,000 ha plantation in Indonesia is around US$25

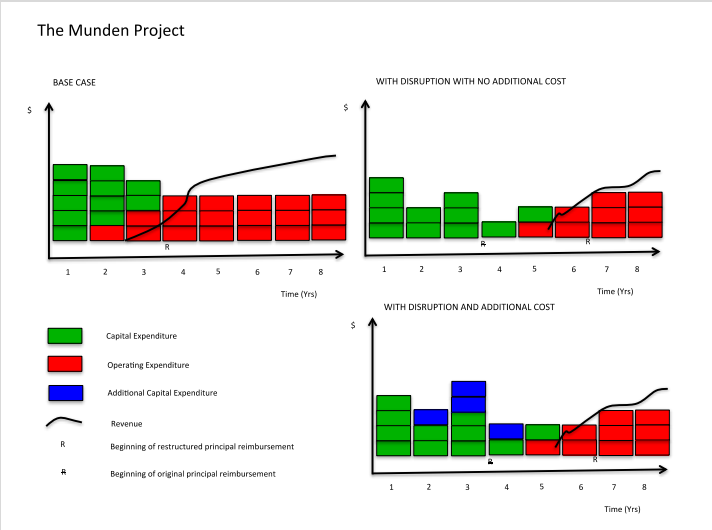
[173] Kartodihardjo and Supriono, "The Impact of Sectoral Development on Natural Forest Conversion and Degradation: The Case of Timber and Tree Crop Plantations in Indonesia."
[174] Ibid.
[175] Mukherjee and Sovacool, "Palm Oil-Based Biofuels and Sustainability in Southeast Asia: A Review of Indonesia, Malaysia, and Thailand."
[176] Ibid.
[177]Winoto, "Paper Presented at the Workshop In International Federation of Surveyors` Forum, Washington DC, March 2009."
[178] Wakker, "Greasy Palms. The Social and Ecological Impacts of Large-Scale Oil Palm Plantation Development in Southeast Asia."
[179] Winoto, "Paper Presented at the Workshop In International Federation of Surveyors` Forum, Washington DC, March 2009."
[180] Larsen et al., "Towards 'hybrid Accountability'in EU Biofuels Policy? Community Grievances and Competing Water Claims in the Central Kalimantan Oil Palm Sector."
[181] Kartodihardjo et al., "Towards Better Forest Governance for REDD+ in Indonesia: An Evaluation of the Forest Licensing System."

million.[182] If an oil palm plantation is trying to operate while in conflict with its neighbouring communities, it could face significant losses, especially if industrial actions take place during harvest time.[183] This is common in areas with tenure conflicts and appears to be becoming ever more damaging for plantation profitability.[184] The Munden Project provides a framework for assessing risks from land tenure conflicts (see Box 3).

Box 3: The Munden Project

The Munden Project[185] produced a report specifically on the case of land tenure and why companies should treat it as more than an 'externality' for investment decisions. They offer three main points of advice: 1) risk assessment of land tenure should be included as standard for any land-dependent investment; 2) losses can accrue from delays in construction, cash flow losses due to suspension of operations or expropriation of assets (Figure 15); and 3) there can be a huge range in impact of the losses, in the case where business operations have a geographic concentration these losses can be 'catastrophic' or 'terminal'. The report argues that even if some companies may be able to manage the financial losses, they could harm their international reputations.

Figure 15: Schematic of additional costs due to delays around land conflicts. Adapted from the Munden Project (2012)[186]



There can also be a complicated relationship between large plantations and local smallholders. In the *plasma/inti* scheme, the company is required by law to provide a proportion of their land for smallholders; however in some cases it is unclear how many plasma plots are actually provided to local community

[182] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[183] Assuming a 60 t FFB/hr mill, running at 22 hours per day, 6 days a week, price is $200/ t FFB and that FFB left in the field are lost. Levin et al., "Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance."
[184] The Munden Project, "The Financial Risks of Insecure Land Tenure: An Investment View."
[185] The Munden Project, "The Financial Risks of Insecure Land Tenure: An Investment View."
[186] Ibid.

members, further increasing tensions.[187] Conflicts and delays to new projects can arise between companies and communities formerly occupying the land designated for oil palm, because government permits have paid little attention to previous land claims, as mentioned earlier. Historically, however, communities have rarely sought justice through the Indonesian courts due to a lack of trust in the judicial process.[188]

Other conflicts arise when independent smallholders are interested in acquiring land. There was a rush for land following the food price spikes of 2008, which created more conflicts over land than local authorities had the capacity to manage.[189] Also, the areas of land that farmers found more affordable were natural forest areas, which cost $500/ha, compared to $1,500/ha for already cultivated land (e.g. rubber),[190] a serious issue for minimising emissions from land cover change. Invariably as land becomes scarcer in Indonesia, land conflicts will continue to arise.[191] Companies must also remain wary of how they respond to growing local tensions and outbreaks of local conflicts, as growing global attention to these issues presents reputational risks and could undermine a company's social licence.

Figure 17: Assets at risk due to land use policy

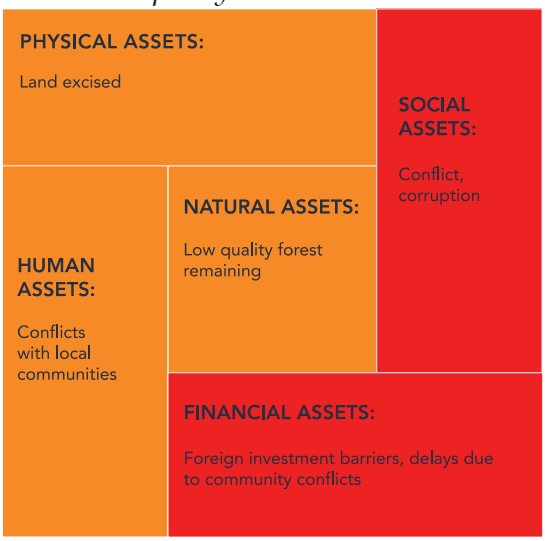


Figure 17 presents our initial assessment of the risk factors from land use policy. In a system where patronage politics is so common, social assets are exposed to the very material risk of conflict and corruption. Restrictions on international investors and foreign ownership generate specific non-trivial risks for non-domestic capital. Human assets, including labour and local communities, face the risk of disruptions to plantation operations, which could affect local livelihoods. There is also the risk of significant discontinuities, where accumulated land disputes and social upheaval result in land expropriation and redistribution.

3.3.4 Reputational risk

The movement towards corporate social and environmental accountability means that unsustainable environmental practices could pose a reputational risk for palm oil companies. Harm to reputations may make it harder for companies to access financial resources and investment, recruit and retain good staff, affect consumer decisions and demand for products, and influence their relationships with suppliers and

[187] Urano, "Impacts of Newly Liberalised Policies on Customary Land Rights of Forest-dwelling Populations: A Case Study from East Kalimantan, Indonesia."
[188] Haug, "Resistance, Ritual Purification and Mediation: Tracing a Dayak Community's Sixteen-Year Search for Justice in East Kalimantan."
[189] Wibowo, Race, and Curtis, "Policy under Pressure: Policy Analysis of Community-Based Forest Management in Indonesia."
[190] Ibid.
[191] Wheeler et al., "Economic Dynamics and Forest Clearing: A Spatial Econometric Analysis for Indonesia."

outlets for their products.[192] Campaigns drawing into question the ethics of palm oil production and the environmental impacts have already prompted changes by targeted companies.

Numerous campaigns have already honed in on particularly charismatic species in Indonesia forests that could be affected by palm oil production.[193] Current estimates of the distribution of the Orang-utan in Borneo show that only 23% of their range falls within protected areas,[194] with 267,000 ha of peatland in Central Kalimantan among their most suitable habitat.[195] Similarly in Sumatra, Orang-utan ranges occur outside of protected areas[196] or in lowland peatlands, making them particularly vulnerable to clearance of new land for oil palm.[197] Orang-utans have featured prominently in campaigns. For instance, in 2010 Greenpeace aired a particularly graphic parody of a KitKat commercial to illustrate the deforestation and habitat destruction resulting from the palm oil sourced from Sinar Mas and used in the candy bar.[198] The outraged public response and potential long-term impacts on sales from this highly visible online campaign, prompted Nestlé to cease purchasing from Sinar Mas and partner with a third party to audit the sustainability of the company's suppliers. It also set a goal to purchase 100% certified sustainable palm oil by 2015. The proliferation of ethical product guides[199] in recent years has made it even simpler for consumers to differentiate products and influence public-facing companies' sourcing decisions.

At present, it does not appear that the Indonesian government plans to drastically change its protected area network; however, it is possible that considerable international pressure may require revoking some timber or oil palm concessions to protect the last remaining habitat of these charismatic animals.

Access to finance that increasingly employs certain social and environmental screening criteria can hinder the palm oil industry. Increasing capital costs for oil palm plantations have required companies to look to bond markets and international public equity for investors.[200] At the same time, a dizzying number of new ESG initiatives are being developed for investors and businesses to ameliorate environmental and social damages. The palm oil sector has seemed particularly problematic for investors, due to the myriad risks already outlined and its general lack of transparency.[201] There are a number of ways investors can influence the business practices of the Indonesian oil palm industry as outlined in Figure 16. The next section in this report, describes ESG initiatives that might be most applicable for the direct and trade financing streams (e.g. lending and letters of credit) for producers and traders.

Figure 17 presents our initial assessment of the risk factors to companies' reputations due to environmental and social transgressions. Negative impacts are expected for human, natural, and social assets, should palm oil companies be publicly identified for illegal practices. Physical assets have a possibility of a major impact due to a significant reduction in land available for cultivation, as biodiversity conservation gains greater priority. Financial assets could be affected as international financial players are unlikely to support companies identified for poor performance as well as reduced profits due to greater local community conflicts.

[192] Ansar, Caldecott, and Tibury, "Stranded Assets and the Fossil Fuel Divestment Campaign: What Does Divestment Mean for the Valuation of Fossil Fuel Assets?"
[193] Greenpeace, "Licence to Kill: How Deforestation for Palm Oil Is Driving Sumatran Tigers toward Extinction"; Leiman, "Palm Oil Development and Biodiversity Conservation."
[194] Wich et al., "Understanding the Impacts of Land-Use Policies on a Threatened Species: Is There a Future for the Bornean Orang-Utan?"
[195] Sumarga and Hein, "Mapping Ecosystem Services for Land Use Planning, the Case of Central Kalimantan."
[196] Meijaard and Wich, "Putting Orang-Utan Population Trends into Perspective."
[197] Gaveau et al., "The Future of Forests and Orangutans (Pongo Abelii) in Sumatra: Predicting Impacts of Oil Palm Plantations, Road Construction, and Mechanisms for Reducing Carbon Emissions from Deforestation."
[198] Ionescu-Somers and Enders, "How Nestlé Dealt with a Social Media Campaign against It."
[199][199] e.g. Ethical Consumer, "Palm Oil."
[200] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[201] Grayson and Stampe, "Palm Oil Investor Review: Investor Guidance on Palm Oil."

Figure 16: Schematic showing where and how investors enter the palm oil commodity supply chain. (Source: BEI 2015).

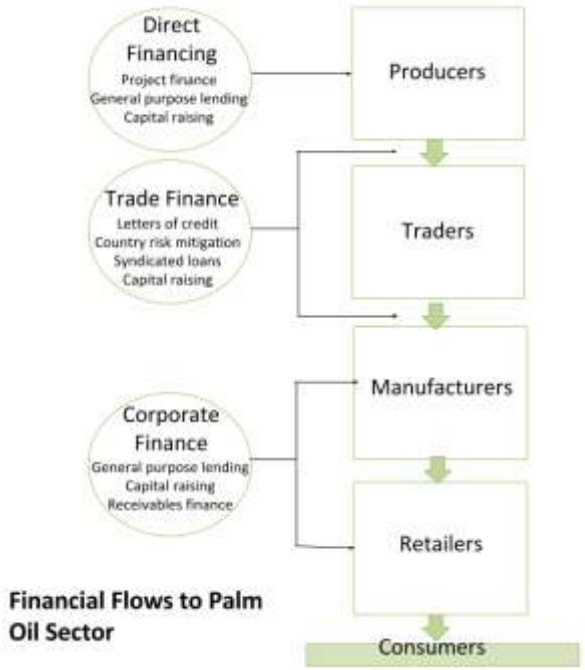
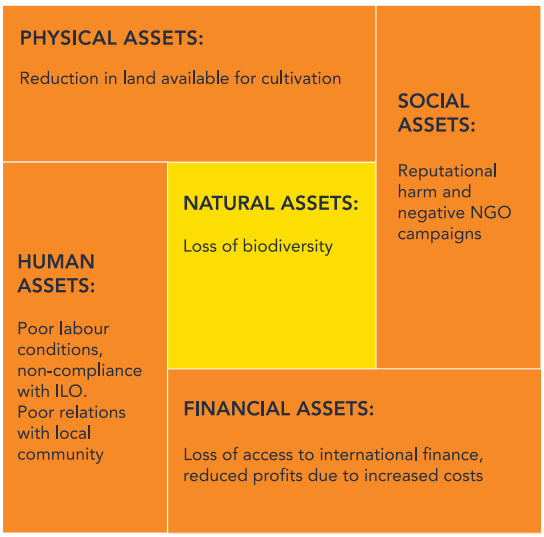


Figure 17: Asset stranding from reputational risks



4 Initiatives aiming to reduce environment-related risk

This section examines a number of private sector initiatives concerned with improving the environment-related practices of the palm oil sector. The initiatives examined are not exhaustive, but are meant to illustrate the range of activities currently attempting to improve palm oil's environmental performance and by so doing, manage some of the risks identified in the previous section. The initiatives are presented and assessed for their ability to address environment-related risk.

We performed a desk-based analysis, whereby we compared the principles and criteria each initiative quantified with our key risk factors elucidated above. We assessed whether the risk factor was a criterion for the initiative, if there were clear recommendations or targets, and whether explicit guidance was provided. We collated these scores and present them as spider diagrams, showing how each initiative scores across our risk factors ('0' indicates the risk was not addressed, '1' mentioned with no clear recommendations or targets, and '2' that there was explicit guidance provided around the particular risk area.)

Table 8: Comparison of initiatives aiming to reduce environment-related risk

Key: 🟢 +2 Explicit Guidance 🟡 +1 Mentioned w/o Target 🔴 +0 Risk not Assessed	RSPO	ISPO	ISCC	HCS	BEI & CGF *	CDP FP	PRI *	Thun Grp.	Combined Initiatives
Land Degradation	🟢	🟡	🟢	🟡	🟢	🟢	🟢	🔴	🟢
Weather Variability	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🔴	🟡
Fire and Air Pollution	🟢	🔴	🟡	🔴	🟢	🟡	🟢	🔴	🟢
GHG Regulation	🟡	🟡	🟢	🟢	🟡	🟢	🟡	🔴	🟢
Biofuel Policies	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🟢
Land Policy and Patronage	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟢	🟢
Increasing Production Costs	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🟡
Reputational Risks	🟢	🔴	🟡	🟡	🟢	🟢	🟢	🟢	🟢
TOTAL (/16):	**10**	**4**	**10**	**4**	**10**	**10**	**10**	**4**	**14**

* Risk score for the initiative rely entirely on companies being RSPO certified

4.1 Roundtable on Sustainable Palm Oil (RSPO)

RSPO certified mills current constitute 11% of global CPO production, which breaks down to 46% from Malaysia, 42% from Indonesia and 9% from Papua New Guinea.[202] The RSPO is a stakeholder-led certification body that was born from a meeting convened by the WWF with a number of retailers (e.g. Migros, Unilever, Aarhus United UK Ltd, Sainsbury's) and producer representatives (e.g. Golden Hope

[202] Ibid.

Plantations Berhad, Malaysian Palm Oil Association (MPOA)).[203] These first seven organisations were dubbed the organising committee (OC) and together chaired the first formal meeting of the RSPO in Kuala Lumpur in 2003. The OC decided to develop a multi-stakeholder model, categorizing membership into seven categories: oil palm growers, palm oil processors and traders, consumer goods manufacturers, retailers, banks/investors, environmental/conservation non-governmental organisations (NGOs) and social/development NGOs. The overarching goal of the group has been to develop a number of principles and criteria that producers can follow to meet "sustainable" production of palm oil.

A strength of the RSPO is the significant engagement by so many large players from the industry; at the same time this may also set the bar too low to achieve significant social and environmental reforms.[204] The scheme consists of eight principles, namely: 1) commitment to transparency; 2) compliance with applicable laws and regulations; 3) commitment to long-term economic and financial viability; 4) use of agronomic best management practice; 5) environmental responsibility and biodiversity conservation; 6) responsible labour practices; 7) responsible development of new plantings and 8) commitment to continuous improvement.[205] Also, once a company begins implementation of RSPO principles it must provide a time-bound plan by when all of its operations will be certified.

Thus far, the main sources of conflict in the process have been how palm oil would be traced throughout the commodity chain, the enforcement of the principle regarding new plantings (e.g. no new forest clearance after 2005), the poor performance by retailers in purchasing certified sustainable palm oil (CSPO), and the lack of criteria or principles on greenhouse gas emissions. Many of these conflicts could be due to the differing outcomes various stakeholders may wish for the sector. For instance, European consumers would prefer the entire industry to become more sustainable, while producers favour a premium to be paid to a niche market allowing the majority of CPO to be produced under business-as-usual practices.[206] The inability of the RSPO to resolve these questions contributed to the main Indonesian growers association, GAPKI, ending its membership in 2011. The reasons they cited were an accusation that input from European sensibilities was too strong and demanding, producers did not have adequate representation, growers were disproportionately bearing the burden of certification, the 2005 cut-off for new plantations should be changed, and the GHG requirements were too burdensome.[207]

The cost of implementing RSPO may be a deterrent for small to medium-sized enterprises. Current estimates have implementation adding 20% to production costs and reducing profits by 40% over a 25-year plantation cycle.[208] Conversely, larger companies unofficially report certification costs of roughly US$5-10/ t CPO, due to the benefits of economies of scale and well-run, long-established plantations. For larger companies coordinating activities across several remote plantations and mills can be a technical challenge, particularly due to inertia in local managers, who may know the right thing to do but are slow to put principles into practice.[209] However, some companies have noted considerable savings by implementing RSPO criteria around free prior informed consent (FPIC) under the principle of responsible new plantings. One company comparing before and after RSPO implementation, noted delays due to conflicts cost them

[203] Nikoloyuk, "Sustainability Partnerships in Agro-Commodity Chains: A Model of Partnership Development in the Tea, Palm Oil and Soy Sectors"; Schouten and Glasbergen, "Creating Legitimacy in Global Private Governance. The Case of the Roundtable on Sustainable Palm Oil. Paper Prepared for the 2009 Amsterdam Conference on the Human Dimensions of Global Environmental Change, Amsterdam."
[204] von Geibler, "Market-Based Governance for Sustainability in Value Chains: Conditions for Successful Standard Setting in the Palm Oil Sector."
[205] RSPO, "Principles and Criteria for the Production of Sustainable Palm Oil: Including Indicators and Guidance. Kuala Lumpur: Roundtable on Sustainable Palm Oil."
[206] Levin et al., "Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance."
[207] Hospes, "Marking the Success or End of Global Multi-Stakeholder Governance? The Rise of National Sustainability Standards in Indonesia and Brazil for Palm Oil and Soy."
[208] Rhein, "Industrial Oil Palm Development Liberia's Path to Sustained Economic Development and Shared Prosperity? Lessons from the East, Rights and Resources Initiative, February 2015."
[209] Levin et al., "Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance."

$15 million for one plantation, compared to investing just $30,000 into community engagement before starting their second plantation. They are confident they will have fewer conflicts.[210]

Implementation of RSPO requirements in Indonesia can be challenging due to conflicts with government policy on land tenure, as described above. This is particularly relevant for the use of the high conservation value (HCV) system for biodiversity mapping. The process of doing an HCV assessment requires the prioritisation of very rare species or forest areas of at least 20,000 ha.[211] Unfortunately, companies that have identified areas for conservation through an HCV assessment have reported being finded or having these lands excised by the government.[212] Often these land areas are provided to less scrupulous companies willing to clear them and plant oil palm. This reveals a serious conflict between the RSPO principles of biodiversity conservation and following local laws and regulations. It is unclear whether certified companies have been able to navigate this contradiction.

While investors view RSPO as minimum due diligence, they are increasingly recognizing that companies need to go beyond its requirements,[213] particularly due to concerns about the RSPO's capacity to enforce what principles and criteria it has agreed to. There is perceived to be a very weak code of conduct, partially due to the RSPO's small operating budget of US$500,000 garnered primarily from membership fees.[214] Only very recently has the RSPO begun decertifying members shown to have violated principles.[215] This lack of enforcement contributed to a diminished impression of legitimacy for the certification scheme. However, as of mid-February 2015, 15 companies have been expelled, and another 62 suspended due to reporting or compliance failures.[216] These moves have been seen as an important step for RSPO and a possible indicator of greater emphasis on accountability and impact.

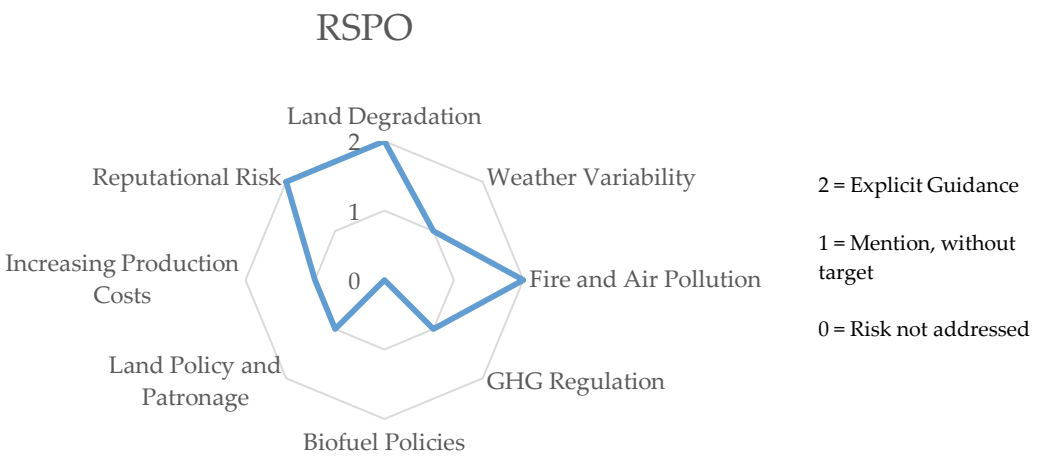
For members frustrated that there was no agreement on a GHG requirement, WWF claimed the RSPO was no longer a benchmark scheme and asked progressive companies to go beyond RSPO, angering medium-sized companies which claim they are not receiving an adequate premium for their CSPO.[217] Currently, there is not considered to be an adequate supply of CSPO to enable segregating certified from non-certified through processing and manufacture. Processors have largely relied on GreenPalm certificates, which correspond directly to palm oil from a certified mill but do not reflect the actual volume of oil used in the final product. It is much cheaper to buy GreenPalm certificates, which trade for about $3/t CSPO than source segregated palm oil, because of economies of scale in processing.[218] In an effort to bring more traceability to the palm oil supply chain, Utz has managed a traceability system to track the actual volume of CSPO as it is mixed with non-certified CPO along the transport chain since 2012.[219] As of January 2015, Utz and GreenPalm have combined their systems to ensure more efficiency in tracking certified oil.

A more lucrative product stream has been the growing demand for palm oil as a feedstock for biofuels, where premiums for CSPO were as much as US$200 per tonne.[220] This stream has more stringent GHG requirements than the RSPO and, for European volumes is managed by the International Sustainability and

[210] Ibid.
[211] Edwards and Laurance, "Green Labelling, Sustainability and the Expansion of Tropical Agriculture: Critical Issues for Certification Schemes."
[212] Levin et al., "Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance."
[213] Grayson and Stampe, "Palm Oil Investor Review: Investor Guidance on Palm Oil."
[214] von Geibler, "Market-Based Governance for Sustainability in Value Chains: Conditions for Successful Standard Setting in the Palm Oil Sector."
[215] Skinner, "Indonesia's Palm Oil Industry Rife with Human-Rights Abuses."
[216] Butler, "Palm Oil Certification Body Purges Membership."
[217] Nesadurai, "Food Security, the Palm Oil–land Conflict Nexus, and Sustainability: A Governance Role for a Private Multi-Stakeholder Regime like the RSPO?"
[218] Shibao, "Up in Smoke: A Study of Palm Oil Related Deforestation in Indonesia. Journal of Environmental Investing 6."
[219] UTZ, "eTrace & GreenPalm Are Connecting and Will Be Live for Users as of Jan 2015."
[220] Levin et al., "Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance."

Carbon Certification (ISCC) body, discussed in more detail later. Currently, however, premiums for ISCC certified palm oil are closer to US$10/t CSPO, after bottoming out in 2014.

Whether retailers and refiners are slow to buy CSPO due to the RSPO's legitimacy problems or because they are waiting to be able to buy purely segregated CSPO, buying of certified volumes has been slow to ramp up. This is expected to change as many companies' commitments to source 100% CSPO by 2015 come due.[221] Unilever appears to be the farthest along in its sourcing plan, which intends to achieve 100% segregated and fully traceable CSPO by 2020. It currently has covered 100% of its palm oil purchases with GreenPalm certificates.[222]



The RSPO is perhaps the most visible initiative. Its limitations have been discussed, namely with respect to ameliorating GHG emissions and enforcing its code of conduct. While it requires adherence to local laws and regulations, meeting principles and criteria (P&Cs) may run contrary to Indonesia's government development preferences and best management for avoiding future disease outbreaks. On the other hand, implementation of its free prior and informed consent (FPIC) criteria has shown documented benefits for plantation development and management due to fewer operational disruptions as well as criteria on minimising chemical inputs that lower production costs. Its benefits for biodiversity protection may not be fully documented; however, its requirement for HCV assessment can contribute to large-scale biodiversity management albeit if supported by provincial level land management. Finally, as the RSPO was created in response to perceived consumer pressure, it is probably the farthest along in terms of a negotiated compromise between oil palm development and ESG considerations.

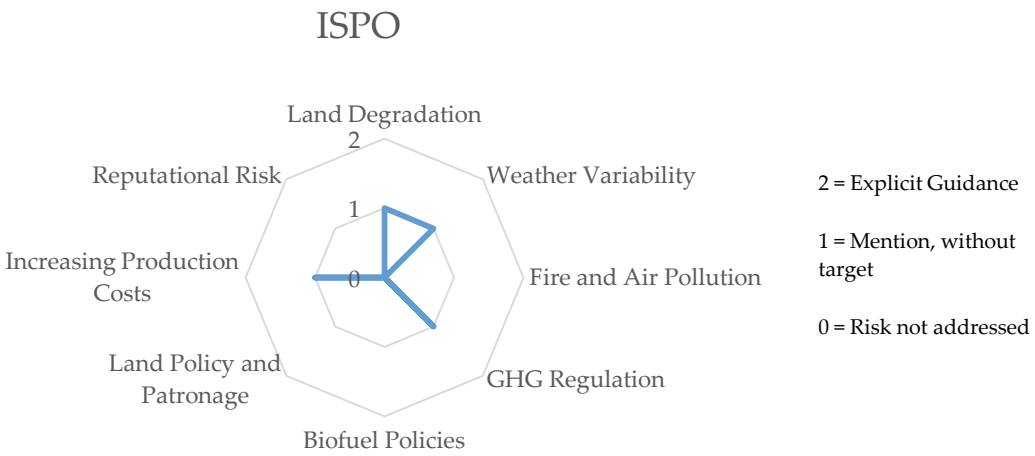
4.2 Indonesian Sustainable Palm Oil (ISPO)

Launched in 2009, the Indonesian Sustainable Palm Oil (ISPO) policy was enacted by the government for multiple reasons: concerns about the slow progress of the voluntary RSPO, the need to meet their deforestation commitments with Norway, and to improve the reputation of Indonesian oil palm internationally.[223] As of 2014, the palm oil production standard and certification process in the country is now a requirement of all producers and companies operating in Indonesia, though 40-50 Indonesian (grower) members have maintained their membership of the RSPO.[224]

[221] Ibid.
[222] Shibao, "Up in Smoke: A Study of Palm Oil Related Deforestation in Indonesia. Journal of Environmental Investing 6."
[223] Hospes, "Marking the Success or End of Global Multi-Stakeholder Governance? The Rise of National Sustainability Standards in Indonesia and Brazil for Palm Oil and Soy."
[224] Ibid.

There are seven principles dictating adherence to the standard: 1) legality; 2) plantation management; 3) moratorium on high carbon stock land; 4) environmental management; 5) responsibility for workers; 6) social responsibility and economic empowerment; and 7) sustainable business improvement. Some of the notable differences between the ISPO and RSPO are that the former allows planting on primary forest and an 'encouragement' to plant on peatland 'environmentally'. Free prior and informed consent (FPIC) is not required and the only negotiation companies are expected to make over land claims is with mining companies. [225] These weaknesses mean that the ISPO is unlikely to address the main concerns of international civil society, particularly in Europe and the US. Indian and Chinese consumers may be less concerned about these lapses.[226]

As the ISPO has not received international recognition, it is not considered an effective response to increasing consumer pressure on palm oil sector practices. In fact except for principles regarding responsible labour and community engagement practices,[227] this scheme has had little impact on the primary risk factors identified.



4.3 International Sustainability and Carbon Certification (ISCC)

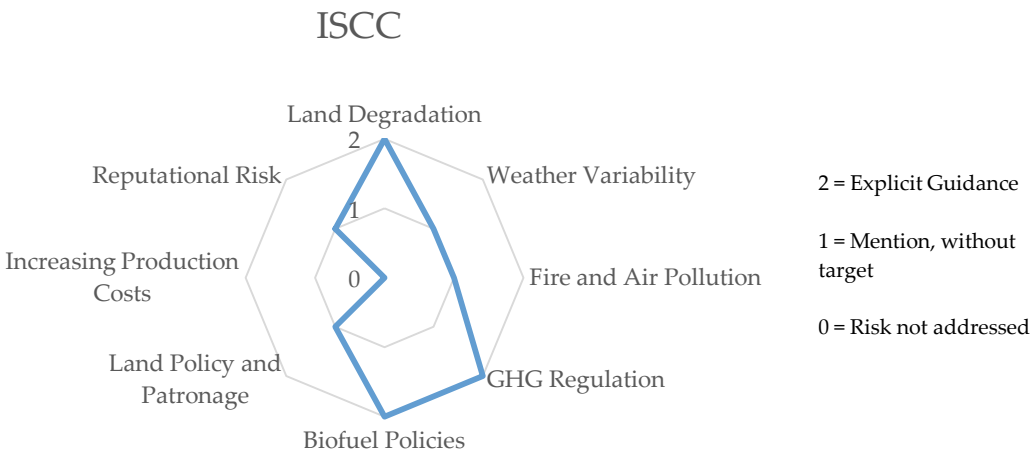
The ISCC was created in 2007 to certify biomass used for fuel to meet the EU's Renewable Energy Directive (RED) greenhouse gas saving requirements, as well as a number of environmental and social criteria. It is a multi-stakeholder operation, and certifies any entity within the biomass and biofuel supply chains (e.g. farm/plantation, mill, trader, refiner and manufacturer). It has developed specific systems to manage different subsector supply chains (e.g. waste, food, feed, chemicals, energy), each in turn having distinct procedures and criteria. Certification centres around three categories: 1) sustainability requirements for cultivation and processing; 2) requirements for greenhouse gas emissions savings and calculation methodology; and 3) traceability and mass balance requirements. Six principles form the basis for assessment: 1) High Conservation Value and High Carbon Stock areas shall be protected; 2) biomass shall be produced in an environmentally responsible way; 3) safe working conditions should be maintained through training and education; 4) biomass production shall not violate human rights, labour rights, or land rights, and promote responsible labour conditions and community relations; 5) biomass production complies with

[225] Ibid.
[226] von Geibler, "Market-Based Governance for Sustainability in Value Chains: Conditions for Successful Standard Setting in the Palm Oil Sector."
[227] Hospes, "Marking the Success or End of Global Multi-Stakeholder Governance? The Rise of National Sustainability Standards in Indonesia and Brazil for Palm Oil and Soy."

all applicable regional and national laws and relevant international treaties; and 6) good management practices shall be implemented.

As described before, it is not immediately evident whether palm oil produced on an average oil palm plantation will meet carbon savings requirements for the EU RED. Ignoring emissions from land use change, Pehnelt and Vietze[228] calculate a 52% carbon saving for electricity production from palm oil and 38-41% savings for biodiesel from palm oil, which equates roughly to 1.6-1.9 t CO_2e/ t CPO. The RED requirement is at least a 35% GHG saving, therefore according to these calculations palm oil is relatively attractive as a feedstock.

The ISCC has the advantage over both the RSPO and ISPO in that it specifically addresses GHG emissions from palm oil production, while including requirements on human rights and biodiversity conservation. This scheme also elicits higher premiums per tonne of CPO. However, its scope will always be limited as only a small proportion of CPO can ever be used for biofuel and large areas of oil palm plantation will not achieve the required 35% GHG savings of the EU RED. Also, there is no requirement for a company seeking ISCC certification to commit to all of its operations meeting the standards, further limiting its influence.



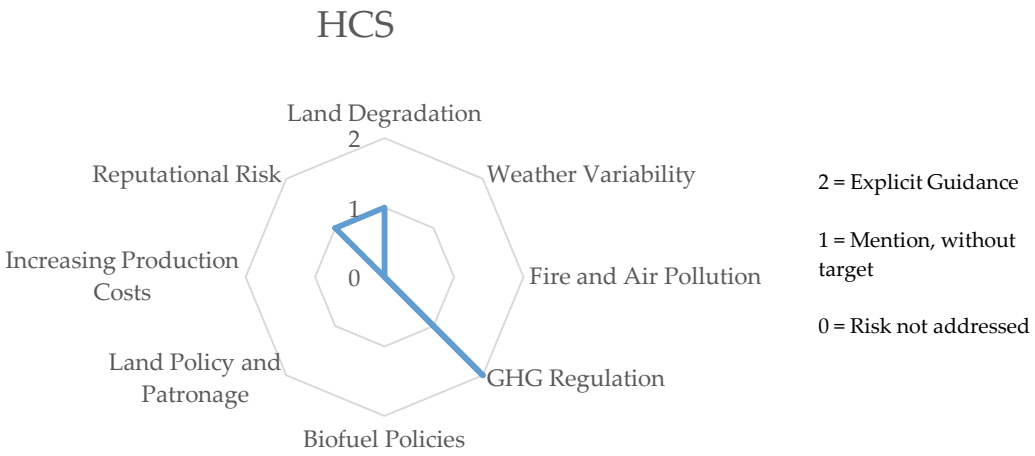
4.4 High Carbon Stock (HCS)

In the interest of establishing a high carbon stock (HCS) value for forests above which no forest should be replaced by oil palm a number of companies and NGOs have commissioned a one year study, led by Jonathon Porritt, John Raison and James Fry.[229] The initiative began in November 2014 and is focusing on Southeast Asian and West and Central African forests. The reference value will be chosen through consultation with local communities and governments as well as considering environmental and regional socioeconomic factors. Several of the companies involved in the process have committed to removing deforestation from their supply chain and halting expansion of their planted areas until this HCS value is agreed. These companies include Asia Pulp and Paper (APP), Cargill, Golden Agri-Resources (GAR), Golden Veroleum Liberia, Wilmar, Agropalma and New Britain Palm Oil.[230] The study's steering committee consists of the Forest People's Programme, Greenpeace, WWF, Agropalma, APP, GAR and Wilmar with the technical support company The Forest Trust (TFT).[231] Finally, observers of the study are RSPO, the

[228] Pehnelt and Vietze, "Recalculating GHG Emissions Saving of Palm Oil Biodiesel."
[229] Butler, "Big Palm Oil Companies Move Forward on Carbon Study."
[230] Greenpeace, "Joint Statement 16th September 2014: Steering Group Established to Oversee the High Carbon Stock (HCS) Approach for Implementing 'No Deforestation' Commitments."
[231] HCS, "High Carbon Stock (HCS) Study for the Sustainable Palm Oil Manifesto."

Sustainable Trade Initiative (IDH), Neste Oil, MPOB, the Global Environment Centre (GEC), Proforest, the Indonesian Oil Palm Research Institute (IOPRI) and the Zoological Society of London (ZSL).[232] The effort is intended to enhance the RSPO requirements through three principles: 1) building transparent and traceable supply chains; 2) hastening the implementation of zero deforestation and no replacement of HCS forest with oil palm, and 3) encouraging socially responsible enterprise.

The HCS is not a full-fledged initiative in itself, as it is intended to support efforts of prominent palm oil companies in making net-zero deforestation commitments. However, we see it as having a positive influence on the reputational risk of early acting palm oil companies, and as trying to ameliorate carbon emissions from land cover change.



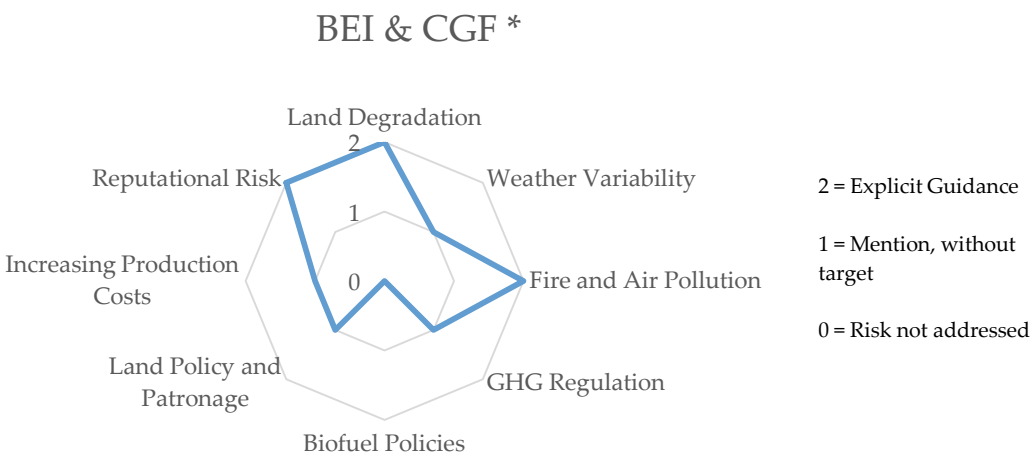
4.5 Banking Environment Initiative (BEI) & Consumer Goods Forum (CGF)

The Banking Environment Initiative (BEI) was convened in 2010 under the auspices of the Prince of Wales's Charitable Trust and the University of Cambridge's Institute for Sustainability Leadership (CISL). The intention of the group is to direct investment capital toward environmentally and socially sustainable development projects. The core banks involved are among the largest in the world: Barclays, BNY Mellon, China Construction Bank, Deutsche Bank, Goldman Sachs, Lloyds Banking Group, Nomura, Northern Trust, Santander, Standard Chartered, Sumitomo Mitsui and Westpac. Among their objectives is to accomplish zero net deforestation of their investments through collaboration with the Consumer Goods Forum (CGF), an effort dubbed the Soft Commodities Compact.[233] The commodities of most interest are timber, soy, palm oil and beef. A growing level of consumption and a perceived lack of demand for CSPO in Asian countries like China, India, and Pakistan partly explains the urgency to focus on palm oil.[234]

One of the BEI's initiatives to accomplish this, the Sustainable Shipment Letter of Credit, to date has focused on the palm oil sector and particularly companies with RSPO certification.[235] The LC was launched at the World Economic Forum in January 2014 and is partnered by the International Finance Corporation (IFC).

[232] Greenpeace, "Joint Statement 16th September 2014: Steering Group Established to Oversee the High Carbon Stock (HCS) Approach for Implementing 'No Deforestation' Commitments."
[233] BEI, "The BEI & CGF's 'Soft Commodities' Compact: Technical Guidance."
[234] BEI, "The BEI Forum 2014, Hong Kong, 24th June."
[235] IFC, "Sustainable Shipment LCs."

For traders of products containing palm oil, the letter allows preferential credit for handling RSPO certified products.[236] As this scheme is dependent on the RSPO, we consider their effectiveness to be the same.



* Risk score for the initiative rely entirely on companies being RSPO certified

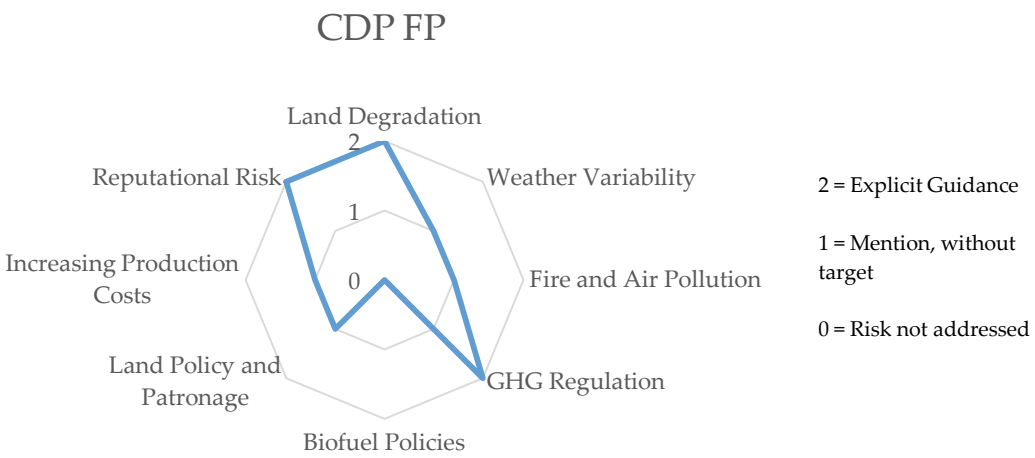
4.6 Carbon Disclosure Project (CDP)

The Carbon Disclosure Project was established in the UK in 2000 and distributed its first emissions survey in 2003, receiving 235 responses.[237] By 2009 this number had increased to 3,000 companies with 82% of the Global 500 reporting.[238] Part of the reason for this rapid adoption of public disclosure was due to the heavy pressure of investor 'members' of the CDP, responsible for $64 trillion in managed capital. In 2012, the CDP joined forces with the Forest Footprint Disclosure Project (FFD), managed by the Global Canopy Programme (GCP), creating the CDP Forest Program. This survey allows companies in the palm oil, beef, soy and timber sector to report progress toward their zero-deforestation commitments. This process generally begins with a public commitment followed by a risk assessment, stated targets and implementation of those targets. According to CDP, the most common implementation strategy consists of certification, supply chain engagement and traceability.[239]

Wilmar International's public commitment 'No Deforestation, No Peat, No Exploitation' by 2020 is an important example, particularly as Wilmar is responsible for 45% of global palm oil trade. Wilmar International is working closely with the Forest Trust (TFT) to trace CPO from all refineries they are responsible for to mills and eventually back to the plantations.[240] A key aspect of this process will be clear definitions of native customary rights (NCR) and a high carbon stock value for the forests they will commit to avoid replacing; hence Wilmar's involvement in the previously described HCS study above. Additionally, a number of institutional investors organised by Green Century Capital, representing half a trillion dollars in assets, are demanding some of the top palm oil companies (e.g. Kuala Lumpur Kepong Berhad, IOI Corporation Berhad and Asian Agri) commit to traceable, net-zero deforestation palm oil production as well.[241]

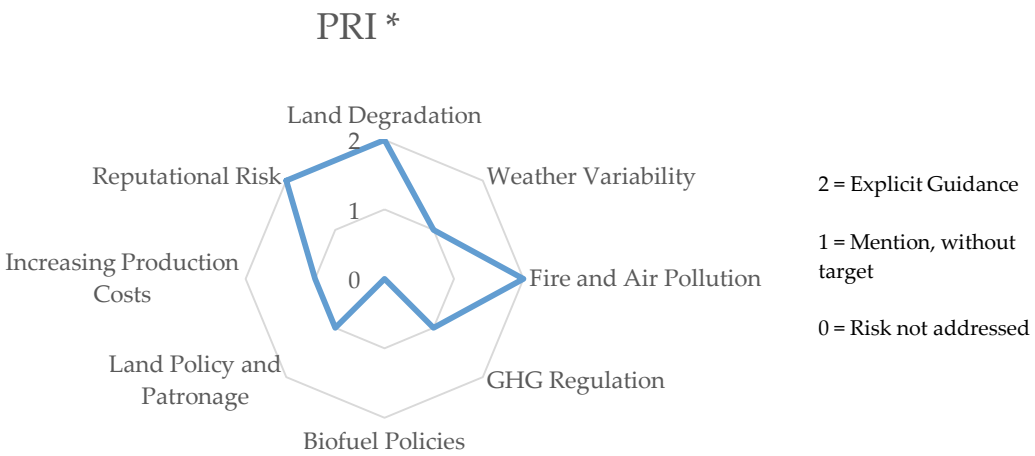
[236] BEI, "The BEI Forum 2014, Hong Kong, 24th June."
[237] Newell, "What Is the Carbon Disclosure Project?"
[238] Winston, "The Most Powerful Green NGO You've Never Heard of."
[239] CDP, "Deforestation-Free Supply Chains: From Commitments to Action."
[240] Wilmar, "Sustainability Report 2013: Transformation through Engagement."
[241] van Reusner, *Indianapolis: Green Century Capital Management*.

Perhaps the most important contribution of the CDP FP is the requirement of a time-bound plan for reporting countries to achieve net-zero deforestation and a mechanism for maintaining transparency while achieving these commitments.



4.7 UN Principles for Responsible Investment (PRI)

In a similar vein to the CDP's forest programme, a Palm Oil Investor Working Group was formed in 2011 under the auspices of the UN Principles for Responsible Investment (PRI). The signatories to the UN PRI pledge to adhere to six principles of responsible investment, which include: 1) integrating ESG considerations into investment analysis and decision-making; 2) integrating ESG considerations into ownership policies and practices; 3) seeking disclosure of ESG issues from investments; 4) promoting implementation of principles; 5) working to enhance effectiveness of principles and 6) reporting activities toward implementing principles.[242]



* Risk score for the initiative rely entirely on companies being RSPO certified

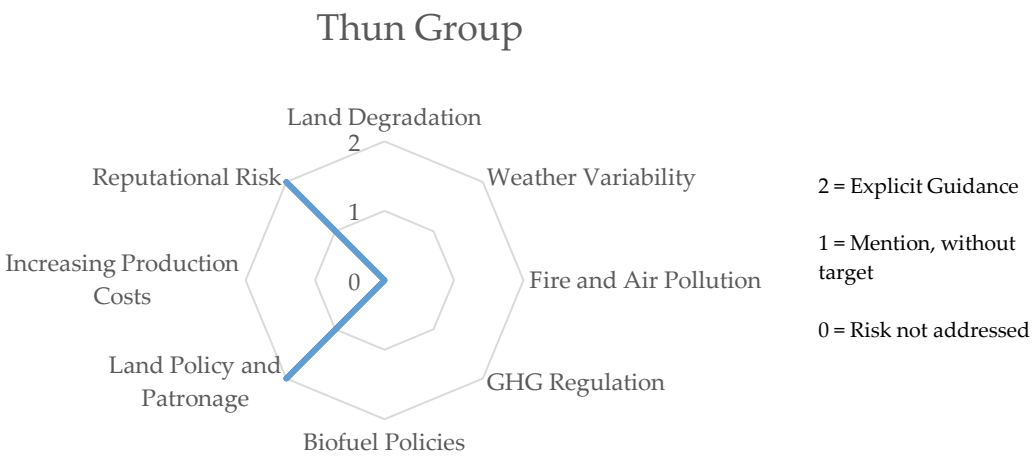
Within that group of institutions, 28 investors, representing $2.8 trillion in managed assets, are engaging with oil palm companies to shift toward certified sustainable production practices.[243] This investor-working

[242] UN PRI, "The Six Principles for Responsible Investment."
[243] UN PRI, "Investors Urge Greater Sustainability Commitments from Palm Oil Producers. Press Release."

group has identified three causes for concern with the oil palm sector: carbon emissions, destruction of watersheds and biodiversity and human rights abuses. They also voice concern that only around a tenth of global palm oil has been certified as sustainable, but applaud commitments made by international buyers to source 100% CSPO in a time-bound plan. According to them, early adopters may 'incur up-front costs but may be able to lock up future supply at better prices and be more competitive than those who do not'.[244] Their main vehicle of sector reform is for companies to become RSPO certified. As this scheme is dependent on the RSPO, we consider their effectiveness to be the same.

4.8 Thun Group

In 2011, the United Nations Human Rights Council (UN HRC) endorsed the Guiding Principles (GP) on Business and Human Rights, developed by Professor John Ruggie. These GPs require businesses to 'protect, respect and remedy' human rights and their abuses in all of their activities. They are intended to push companies beyond voluntary corporate social responsibility (CSR) efforts toward the integration of protecting human rights in core corporate practices. However, the principles have been kept vague so that individual sectors can develop their own relevant rules by which to operate. To address this need for the financial sector four universal banks (Barclays, Credit Suisse, UBS and UniCredit), which are involved in both commercial and investment banking, informally declared themselves the Thun Group in October 2013.[245]



They produced, with the addition of BBVA, ING Bank N.V. and RBS Group, a discussion paper titled *The Guiding Principles on Business and Human Rights: An interpretation for banks*, outlining how they intended to implement the GPs. This report received a mixed response, while it was considered on balance a paradigm shift for the sector it also had some shortcomings regarding its full responsibility for impacts of investment.[246] Among these critiques is the document's discussion of leverage and whether an investor really has as much influence over a client's behavior as generally assumed. The report states that a bank may be limited in assessing the impact of its business practices due to proximity rather than severity of a human rights risk.[247] This interpretation runs contrary to the view of the architect of the GPs, Professor Ruggie, who states, 'It does not make a difference how many layers you have. If you caused the problem, you are responsible for it'.[248] It is unclear what the discussion paper released by the Thun Group may lead to

[244] Ibid.
[245] Thun Group of Banks, "UN Guiding Principles on Business and Human Rights. Discussion Paper for Banks on Principles 16-21."
[246] de Felice, "Banks and Human Rights Due Diligence: A Critical Analysis of the Thun Group's Discussion Paper on the UN Guiding Principles on Business and Human Rights."
[247] Ibid.
[248] Meyerstein, "Are Big Banks Short-Selling Their Leverage over Human Rights?"

in terms of implementation.[249] Regardless, sector-wide reform of the financial sector could have massive implications for the human rights abuses of which the Indonesian oil palm industry is accused.

The Thun Group goes farthest in terms of addressing human rights abuses, by essentially withdrawing financial support to unscrupulous companies. While the critiques of the group's first report described above are no doubt valid, it is likely that the abuses of the oil palm sector would be difficult for an investor to ignore. Certainly, should these principles of 'protect, respect and remedy' become fully integrated across the financial sector, past illegal claims of community and indigenous lands across Indonesia may have serious ramifications for the industry's ability to acquire much needed capital from international players.

4.9 Discussion

Indonesia's specific challenge of entrenched patronage politics remains a central issue despite these initiatives. Voluntary or international commercial initiatives have very limited ability to challenge national government's sovereignty. There are signs that the Indonesian authorities are keen to change this dynamic, such as through its significant GHG commitments and constitutional ruling on respecting customary land claims. Conversely, its movement toward limiting foreign ownership of plantations and development of the ISPO may be perceived as a means of reducing external oversight of its palm oil sector, further entrenching current businesses practices. Finally, there do not appear to be any ESG initiatives to directly address potential impacts of climate change on the productivity of the palm oil sector. This may not be so surprising considering there remain large uncertainties regarding future climate conditions and implications for disease vectors. The other identified risk factors are certainly expected to impact the oil palm industry long before temperature and sea-level rises have discernible effects on global palm oil supplies.

For the overwhelmed investor, the following section will discuss ESG performance and engagement of prominent palm companies across these initiatives. Particularly for the largest, most visible companies adoption of a combination of initiatives is common. This practice may more effectively address the range of risk factors we have identified. Looking at a spider diagram combining the ISCC, CDP FP and RSPO, it is evident most risk factors are at least partially addressed.

[249] de Felice, "Banks and Human Rights Due Diligence: A Critical Analysis of the Thun Group's Discussion Paper on the UN Guiding Principles on Business and Human Rights."

5 Assessing investor and company risk exposure

In order to develop a sense of the extent to which these risk factors are of concern and being addressed by companies and investors, this section presents the top 20 palm oil companies, ranked based on net income from Bloomberg and listed by the proportion of Indonesia's total planted area they represent in Table 9, as well as their engagement with producer-focused ESG initiatives (e.g. RSPO, ISPO, ISCC, HCS and CDP FP). We posit that palm oil companies are engaging with these initiatives in order to lessen their exposure to reputational risk or because they have been pressured to improve their transparency and/or ESG record for international investors. Due to the lack of transparency across such an undifferentiated supply chain, more responsible companies are keen to distinguish themselves from the industry at large. Combined the 20 companies we have chosen are directly responsible for around 30% of total planted oil palm areas in Indonesia and total crude palm oil, and nearly three-quarters of palm oil market share (Musim Mas and Cargill comprise most of the remaining). It is interesting to see that most of these companies have engaged with the RSPO, ISPO, and ISCC, with only very few involved with the CDP Forest Program.

In addition, there have been several systematic assessments made of some of these large companies by a number of NGOs (two of which are presented in Table 9). These have been primarily desk-based analyses, looking at documented policies on a range of sustainability indices[250] (e.g. the Zoological Society of London's Sustainable Palm Oil Transparency Tool (SPOTT)) mostly based on declared zero deforestation policies (e.g. Forest Heroes Green Tigers report).[251] We use these as proxy measures of environmental and social governance performance for our identified companies. In the case of SPOTT, ZSL provides a detailed framework assigning of points for a number of principles, and resulting in a percentage score and colour code. The Green Tigers report provides three rankings of performance: good, unclear or ambiguous and poor. These are based on a company's behaviour around protection of forest/high conservation value area, high carbon stock land, peatlands and human rights. As many of these assessments consider whether a company engages with ESG initiatives, it is not surprising that companies with engagement across all listed initiatives receive higher scores from both SPOTT and Green Tigers.

It is revealing that the only three companies that have received a 'good' report from Green Tigers are involved with RSPO, ISPO, ISCC and in some cases HCS combined. More than half of the companies dubbed 'poor' have only adopted RSPO and/or ISPO certification. Comparing companies' SPOTT scores, the highest average SPOTT score are for companies that are engaged with HCS (55%), as they are generally involved with all of the other schemes as well. Similarly high average SPOTT scores go to companies engaged with ISCC (51%) and CDP FP (50%). Companies with only ISPO certification score dismally low (22%) and the average RSPO engaged company score (45%) is only marginally improved if they also undertake ISPO (46%). These are relatively static studies, however, as they are primarily based on reviews of existing company policy and have only minimal capacity to on-the-ground verification. Therefore, we present a brief review of legal and financial impacts following infractions by these identified companies.

[250] ZSL, "Sustainable Palm Oil Transparency Toolkit."
[251] Hurowitz, "The Green Tigers: Which Southeast Asian Companies Will Prosper in the New Age of Forest Conservation."

Table 9: Listing of top 20 Indonesian palm oil companies with details of certification and third-party evaluations

Company	Net Income ($mil.)	% Indo Planted Area	RSPO	ISPO	ISCC	HCS	CDF FP*	SPOTT	Green Tigers
Golden Agri Resources (GAR)	383.7	4.50%	Y	Y	Y	Y	NR	63.60%	GOOD
Salim Ivomas Pratama Terbuka PT**	53.4	3.20%	Y	Y	-	-	NR	46.00%	POOR
Astra Agro Lestari Terbuka PT	116.3	2.70%	-	Y	-	-	NR	14.50%	POOR
Sime Darby Plantation	669.1	2.70%	Y	Y	Y	-	NR	63.60%	UNCLEAR
IndoAgri	48.8	2.40%	Y	Y	-	-	-	-	POOR
First Resources Limited	141.6	1.90%	Y	Y	Y	-	NR	20.00%	POOR
Genting Plantations Berhad	61.8	1.70%	N	Y	-	-	NR	29.10%	-
Wilmar Group	893	1.60%	Y	Y	Y	Y	Y	45.50%	GOOD
Bumitama Agri Limited	45.4	1.40%	Y	Y	-	-	NR	30.90%	UNCLEAR
Austindo Nusantara Jaya	32.2	1.30%	Y	Y	Y	-	NR	-	-
Sinar Mas (SMART)**	62.8	1.30%	Y	Y	Y	-	NR	63.60%	GOOD
PP London Sumatra Terbuka PT	57.4	1.20%	Y	Y	-	-	NR	43.60%	-
Kuala Lumpur Kepong Berhad	211.1	1.00%	Y	Y	Y	-	NR	41.80%	POOR
REA Holdings PLC	53.5	1.00%	Y	Y	Y	-	-	-	-
IOI Corporation Berhad	421.2	0.50%	Y	-	Y	-	Y	54.00%	UNCLEAR
SIPEF	46.1	0.40%	Y	Y	Y	-	NR	56.00%	-
Kulim (Malaysia) Berhad	62.3	0.40%	Y	-	-	-	NR	50.90%	-
FELDA	154.9	0.40%	Y	-	-	-	NR	-	UNCLEAR
Socfin Group S.A.	67.9	0.40%	Y	-	-	-	NR	33.60%	-
United Plantations Berhad	56.1	0.20%	-	-	-	-	-	60.00%	-

**NR* refers to "no-response" as reported in (CDP, 2014).
**Salim Ivomas is a subsidiary of IndoAgri and SMART is a subsidiary of GAR
Note: Companies are listed in order of percent of total Indonesian planted area and whether any of their operations are RSPO, ISPO or ISCC certified. Their involvement with the HCS initiative and reporting to the CDP FP is noted. Finally, rating of their sustainability performances by the Sustainable Palm Oil Transparency Toolkit (SPOTT) and Green Tigers are presented.

In terms of the risk factors identified by this report, the release of GHG emissions via illegal deforestation, clearance of HCS forest and cultivation of peatlands are perhaps the most visible (e.g. discernible via basic satellite imagery analysis). By the end of 2014, some form of a zero-deforestation pledge applied to approximately 96% of the global palm oil trade.[252] As discussed, however, this is largely due to the consolidated nature of the oil palm market, which may make enforcement by multinational traders difficult. With the exception of the Thun Group, all of the ESG initiatives presented addressed GHG emissions, and understandably infractions related to land conversion were the most commonly reported. For example, in May 2015, Golden Agri-Resources (GAR), a company comprising 14% of the total palm oil trade, was banned from developing new plantation areas by the RSPO because of allegations over land rights abuses.[253] Around the same time, Jardine Matheson Group (of which Astra Agro Lestari is a subsidiary) came under attack for destroying peatland and high conservation value areas.[254] Bumitama was threatened with the loss of support from its investor Rabobank and formally dropped by Deutsche Bank for peatland and forest clearance in Indonesia.[255]

[252] Finkelstein, "The Chain: 96% of Global Palm Oil Trade Covered by Zero-Deforestation. Chain Reaction Research."
[253] Coca, "International Body Freezes Expansion of Palm Oil Giant."
[254] Cushing, "Jardine Matheson under Fire for Deforestation Connection, Portending Increased Focus on Growers."
[255] DutchNews, "Rabobank under Fire over Indonesia Palm Oil Investments"; Mongabay, "Deutsche Bank Dumps Controversial Palm Oil Company."

While the RSPO is still considered the most comprehensive in addressing the risk factors outlined in this report, its historically limited enforcement has threatened its legitimacy to investors and observers. Efforts like the CDP and ISCC are monitoring many of the important drivers, but the former has no enforcement powers to change unsustainable behaviour and the latter only applies to a subset of relevant plantations. Certainly, the ISCC has limited its impact by focusing on international biofuel trade as a potential driver of large-scale deforestation. Finally, as stated previously, the ISPO has demonstrated the least potential to address any of the drivers of stranded assets identified, and therefore, should not be expected to bring about large-scale reform of the Indonesian oil palm sector.

Box 4: Palm Oil Islamic Finance

The intersection between palm oil and Islamic finance is large, with the Malaysia the clear epicenter. Malaysia is reportedly seeking to attract Middle East capital and palm oil is one of the key aspects for facilitating this influx. In order to do so, the country has been developing shariah-, or Islamic religious law-, compliant products that would allow Gulf investors to commit capital. Efforts to do so have included the establishment of a shariah-compliant commodities exchange, as well as tax breaks designed to stimulate higher sukuk bond issuance.

One area important to the CPO to financial markets, which has seen strong growth over the last few years, has been issuance of sukuk-shariah compliant bonds by palm oil companies. Bursa Malaysia, the country's eponymous exchange, is based in Kuala Lumpur and is the world's largest palm oil trading hub and has been since 1980. Palm oil futures trading accounts for the majority of volume on the exchange. In 2009, the country launched a new internet exchange, the "Bursa Suq Al-Sila", for trading commodities, including CPO, in a shariah-compliant setting.

So far issuance of sukuk bonds has been dominated by Malaysia. In fact, a group of five banks there (Maybank Islamic, AmIslamic Bank, RHB Islamic Bank, Public Islamic Bank and Hong Leong Islamic Bank) have been issuing large amounts of Basel III compliant sukuk bonds. However, Goldman Sachs and Société Générale have also recently arranged sukuk issues, with Goldman's being on its own behalf. According to the Financial Times, the 'UK, Luxembourg and South Africa are getting in on the game, Turkey and Indonesia are looking to build on recent issuance, and Saudi Arabia is beginning to fulfill its sukuk potential.'

This growing international involvement is important to mention because it may mean CPO-related sukuk bonds will become held by a wider range of investors globally.

5.1 Market Analysis

This section surveys the available data on company ownership, financial ratios, and debt issuance. We use S&P Capital IQ to construct a representative sample of the Indonesian and Malaysian palm oil industry. In total, we identify 49 palm oil companies for analysis. First, we identify palm oil companies which list palm oil as an industry or product segment. The total landbank and proportion of revenue from palm oil is listed in Appendix A, in addition to key balance sheet fundamentals. Second, we filter the results by including companies which list Malaysia and/or Indonesia among the top three geographical segments of operations. For the most part, the companies' headquarters were also listed in Indonesia and/or Malaysia.[256] Of the 49

[256] Five companies were listed in Singapore, two in Luxembourg, two in the United Kingdom, and one in Belgium.

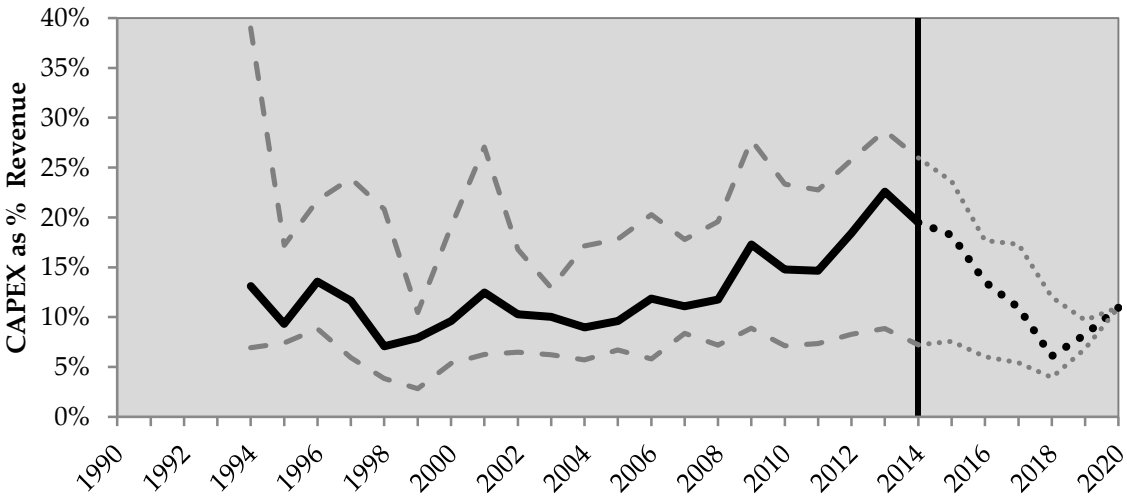
companies, we examined whether the ultimate corporate parent was private or public: results show 13 private listings and 36 public listings.

5.1.1 Capital Project Expenditure

The future capital plans of palm oil companies influence their exposure to environment-related risks. Capital expenditure (CAPEX) represents the funds used to acquire, upgrade, or maintain physical assets within a firm. As noted, the first three to four years of palm oil operations are typically dedicated to establishing plantations, while the optimal yields are achieved from about ten years of age onwards. This implies that the palm oil industry has large amounts of capital invested in palm oil, significant lead times, and a lengthy payback period.

Figure 18 illustrates the median historical and projected CAPEX of the 49 palm oil companies between 1994 and 2020 (where data were available).[257] CAPEX is scaled by revenue to control for firm size. The figure also includes 25th and 75th percentiles as a measure of central tendency. The figure illustrates that CAPEX/Revenue has generally increased from 1998 onwards, with 2013 being the most CAPEX intensive year for the palm oil industry. Analysts forecast that CAPEX/Revenue will decline over the coming years.[258] The underlying data show this is primarily due to lower forecasted CAPEX rather than increasing revenue.

Figure 18: Capital Expenditure Projections as a Percentage of Revenue



5.1.2 Ownership Trends

The ownership trends of the palm oil companies will influence their decision-making processes. In particular, the corporate governance of entirely state-owned versus privately owned companies are likely to differ.

Appendix B presents locational and ownership data regarding the 49 palm oil companies. The data include the head office location, the top three geographical segments by market value, the ultimate corporate parent of each palm oil firm, and whether the corporate parent is a public or private company. Appendix C expands on the data by presenting the ownership breakdown, as measured by market value, of both the palm oil firm and ownership of the ultimate corporate parent. Figure 19 provides a summary of the data, while definitions regarding each ownership type are provided in Table 10.

Table 10: Definitions of ownership types

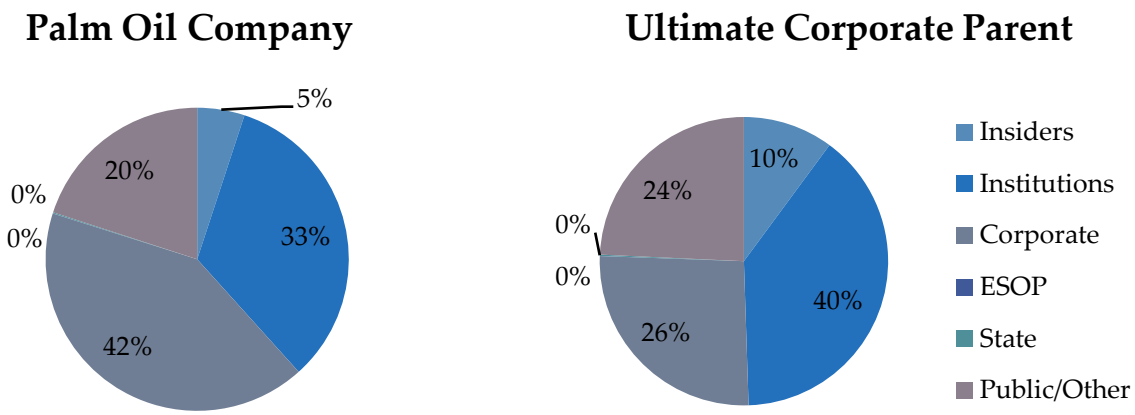
[257] Historical data and estimates are extracted from S&P Capital IQ. All data measured in $USD millions. Data unavailable prior to 1994. Projections unavailable for all companies.
[258] Note, the 2015 forecasts contain 32 companies, declining to one company by 2020. The small sample in later years can bias results.

Owner	Definition[259]
Insiders	Includes Officer and Director ownership as well as non-Officer/Director 'people'.
Institutions	Institutions represent non-strategic, institutionally owned shares.
Corporation	Public or private company ownership in the target company. This specifically excludes public investment firms. Often, information is scarce on whether an entity is a private firm or private company. Capital IQ tends to assume private company unless other information counters that assumption.
*ESOP**	This entity is normally designated as a "Pension Fund (Internally Managed)" Institution type. Almost all ESOPs hold one stock, and it will be the parent of the ESOP firm.
State	Shares owned by a Government Institution directly. This doesn't not include Government Pension plans, or general Sovereign Wealth Fund ownership.
Public/ Other	Public and Other equals total shares outstanding minus the sum of Institutions and all other Strategic Owners.

* Employee Stock Ownership Plan (ESOP)

The data show that *corporate* holdings represent 42% of the palm oil companies' market value, institutions are ranked 2nd holding 33% of market value, public ownership is ranked third at 20%. State, ESOP, and Insiders represent around 5% of ownership. When considering the ultimate corporate parent, institutions hold the largest share of equity, 40% of total market value, while corporations' ownership declines to 26%. Public and Insider ownership of the corporate parent are both marginally greater, at 24% and 10% respectively. Overall, the data show that the palm oil companies are primarily held by institutions and corporations.

Figure 19: Ownership Structure of companies and ultimate corporate parents



5.1.3 *Financial Ratios Analysis*

Exposure to high levels of debt increases risk for both debt and equity holders of the palm oil industry. To build a general picture of the future direction for bond issuances in the industry, fixed-income securities are examined through ratio analysis. A number of financial ratios are examined, including those related to profitability, capital expenditure, liquidity, leverage, debt coverage, and the ability for palm oil companies to service existing debt. The analyses are conducted between 1990 and 2015 to represent the last 25 years of data.[260] The dataset for 2015 was limited, and thus was omitted. The analysis only includes publicly traded palm oil companies as some financial data were unavailable for private firms. Appendix D reports the median values for the financial ratios across time, while Figure 20 presents the median ratios with 25th and

[259] Definitions are extracted from S&P Capital IQ.
[260] Data were extracted from S&P Capital IQ.

75th percentiles. Appendix E reports the financial ratios at the firm-level. Plot (A) of Figure 20 illustrates the number of companies in the sample through time.

The first ratios examined focus on the general profitability and capital expenditure in the palm oil industry, both of which relate to the industry's ability to service its debt commitments. Chart B of Figure 20 presents the gross profit margin of the palm oil industry. The gross profit margin of the industry typically fluctuates around 30%, but the percentiles show high variability in gross margins post-1994. The net income margin in Plot (C) shows greater volatility; the most profitable year for the industry was 1996, while the least profitable was 2002. The palm oil industry began to recover until 2012, where net profit margins declines to around 10%. The industry showed little sensitivity to the global financial crisis continuing to increase in profitability and this was likely the result of this coinciding with a period of high commodity prices. Overall, the ratios indicate that the industry remains relatively profitable.

Capital expenditure (CAPEX) represents the funds required to acquire, maintain, or upgrade existing physical assets. CAPEX is scaled by revenue to account for differences in firm size. Plot (E) shows that the ratio has been steadily increasing through time. In 1996, CAPEX represented approximately 9.33% of revenue, increasing to 22.58% in 2013. The results suggest that operations are becoming increasingly expensive in the industry.

The current ratio and acid tests are used as a proxy for liquidity in the palm oil industry. The former ratio measures the ability to service current liabilities using current assets, while the latter measures the ability to service current liabilities using cash, near-cash equivalents, or short-term investments. Charts (E) and (F) show that liquidity has remained relatively stable over the time period. The range between the percentiles shows that the liquidity ratios are highly variable across companies, particularly from 2000 onwards. The high quick ratio shows that the industry is typically holding large amounts of cash or near-cash equivalents. For the majority of the time series, the liquidity ratios fluctuate around or above unity, indicating that the firms are able to service their short-term liabilities.

We examine two financial leverage ratios: debt/equity in Chart (G), and debt/capital in Chart (H). Both ratios show a large increase in leverage in 1998, where the palm oil industry substantially increased its use of debt in its capital structure. Despite this increase in debt, the median ratios show that the value of debt rarely exceeds that of equity. The large 75th percentile shows that, post-1996, a small number of companies have increased their use of debt to levels which exceed more than half of the capital employed. This small number of companies will be the most susceptible to financial risk, interest expenses, and volatile earnings. These highly-leveraged companies can be identified in Appendix E.

Coverage ratios measure the industry's ability to meet its financial obligations. Three ratios are considered: 1) EBIT/interest, 2) EBITDA/interest, and 3) (EBITDA-CAPEX)/interest. The EBIT/Interest ratio in Chart (I) shows that the operating income of the industry is typically about nine times greater than interest expense. However, the percentiles show that some companies' EBITs are many times greater than interest expense, particularly in 2012 and 2013. Chart (J) considers EBITDA, which accounts for large depreciation and amortization on assets. The results show that depreciation and amortisation have little impact on this ratio. Chart (K) shows that CAPEX considers the impact of capital expenditures on the industry's ability to cover interest expenses. When deducting annual CAPEX, the ratios remain relatively high. The overall conclusion drawn is that, based on the current profitability, the industry is able to service its current debt commitments.

Figure 20: Financial ratio analysis including the median values and 25th and 75th percentiles

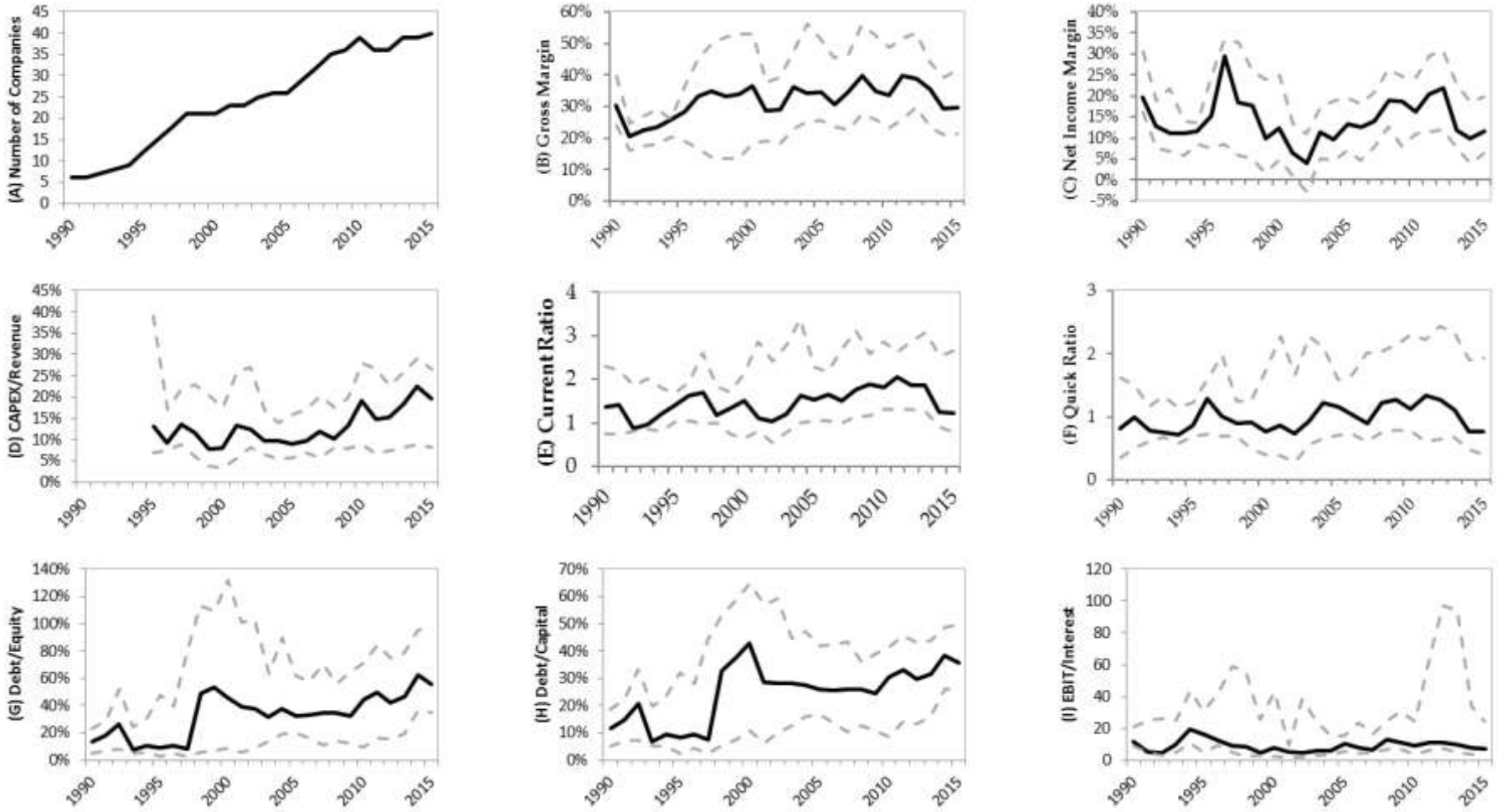
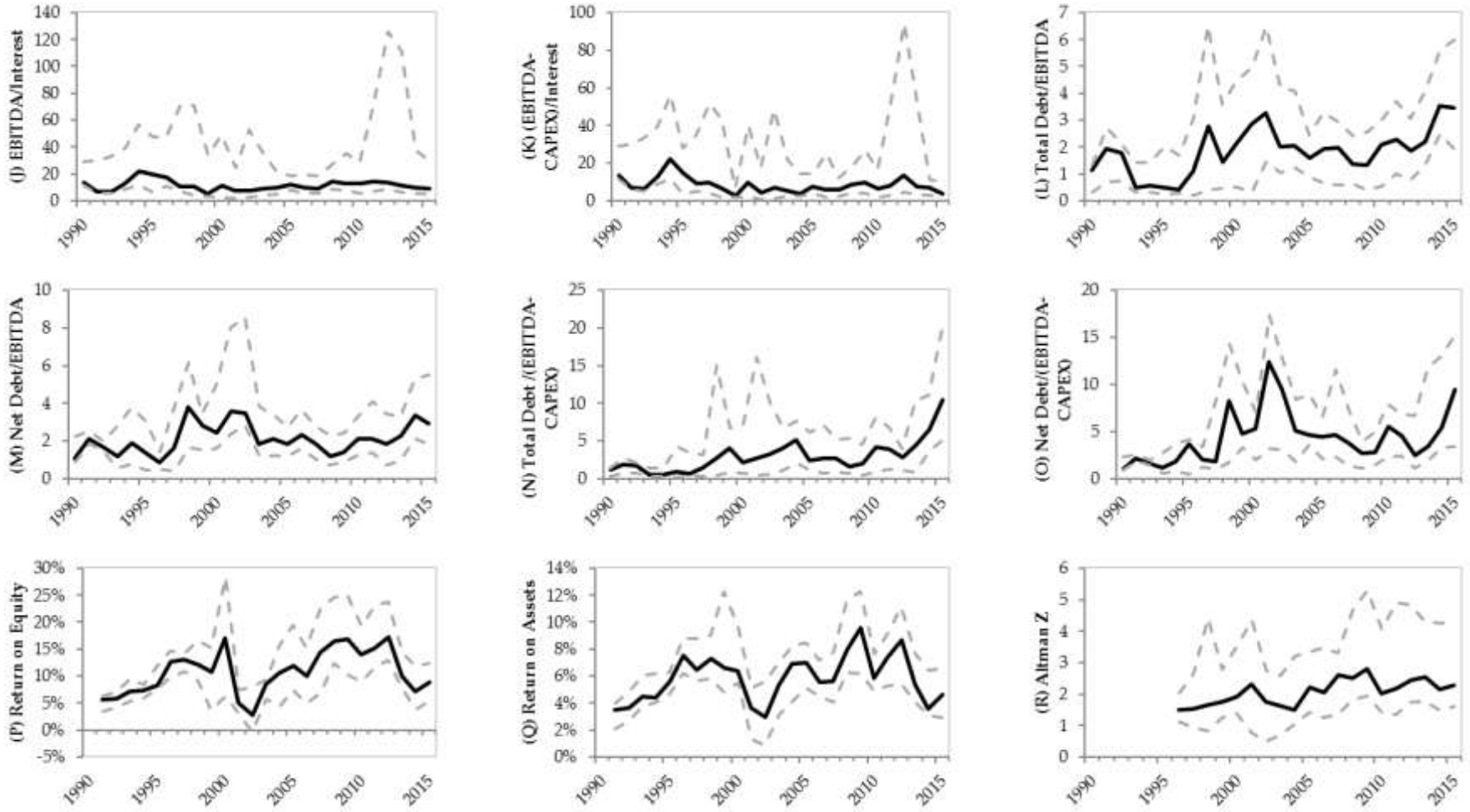


Figure 20 (continued)



The next four ratios represent the industry's ability to retire incurred debt. The ratios can be broadly interpreted as the amount of time needed to pay off all debt, ignoring interest, tax, depreciation and amortisation. The ratios are divided into two groups: group 1 considers the numerators: 'total debt' and 'net debt', where the latter subtracts cash and near-cash equivalents for total debt; group 2 considers the denominators: EBITDA and (EBITDA-CAPEX), where the latter controls for capital expenditures.

The results show that the time taken to retire total debt (Chart L) and net debt (Chart M) using current income is increasing. In 2015, Chart (L) shows it will take 3.44 years to retire total debt using current operating income' Chart (M) shows 2.93 years to retire net debt after utilizing near-cash equivalents. When deducting CAPEX, both ratios dramatically increase. In 2015, Chart (N) reports that the median number of years to pay back total debt is 10.39 years; Chart (O) reports 9.42 years to retire net debt. All four ratios indicate that the industry is taking on an increasing amount of debt, which will take longer to retire.

We consider two ratios that examine the company's performance with regards to managing the equity and debt entrusted to it. The first ratio in Chart (P), Return on Equity, measures the company's ability to employ equity capital. The second ratio in Chart (Q), Return on Capital, also includes debt in the capital structure. Both ratios show a similar trend. The palm oil industry's performance was generally good until 2000, when both Returns on Equity and Capital decline. The industry recovered over the following years until 2012, but 2013 onwards have been particularly difficult years for the industry.

We also consider Altman's Z[261] as an additional financial ratio regarding the financial health of a firm. The Altman's Z-score was developed as a ratio to predict the probability that a firm will become bankrupt within the next two years. The Z-Score predicts corporate defaults based on the company's balance sheet and income statement, providing a simple measure of financial distress. Values above 2.99 are generally considered safe, while values below 1.81 are considered distressed. The results show that the industry experiences two periods of relative distress: 1996-1998 and 2002-2004. Beyond these two periods, the industry typically fluctuates in the grey area between distress and good financial health. The 25th and 75th percentiles show that there is some dispersion in the results: Some palm oil companies experience greater financial distress throughout the time periods, while other experience good financial health.

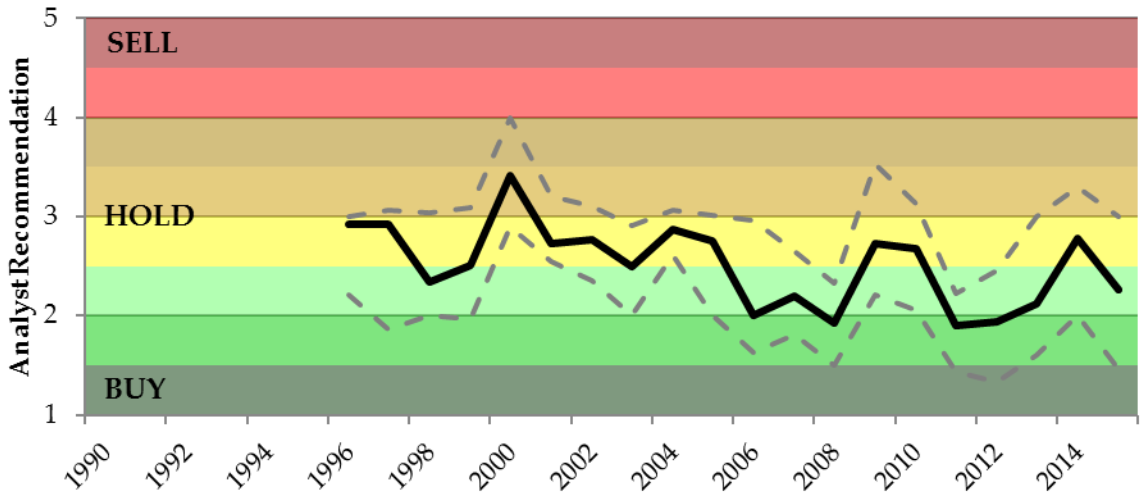
In addition to Altman's Z, we obtain analyst recommendations, by company and year. The purpose of providing the data is not to recommend buying or selling palm oil stocks, but to illustrate the market's perception of the current and future prospects of the industry. As investors are expected to be rational, wealth-optimising individuals, they should re-evaluate their position today based on perceived changes in future cash flows.[262] Further, rational investors are expected to examine and consider all potential future scenarios, including those that are difficult, hard-to-value strategic options.[263] These future scenarios should include the potential social cost of palm oil, and consider the possibility of reputational risk facing companies operating in the palm oil value chain. The analysts' recommendations provided are between 1 and 5, where 5 represents a strong sell recommendation and 1 represents a strong buy recommendation. Across the companies, we take the mean recommendation and the 25th percentiles.

The data, illustrated in Figure 21, show that analyst' recommendations are relatively volatile across time. For the most part, analysts recommend 'holding' palm oil stocks but the percentiles show that some palm oil stocks are assigned strong 'buy' recommendations. This effect is increasing in recent

[261] Altman, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy."
[262] Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk*."
[263] Griffin et al., "Science and the Stock Market: Investors' Recognition of Unburnable Carbon."

years. The sell recommendations typically occured around 2000, when the industry was in financial distress. The lack of sell recommendations beyond this time period potentially indicates that the market does not recognise increased costs of operations in the future. Alternatively, it suggests the ability for the company to adapt operations to mitigate social and reputational risks, or the ability of investors to mitigate these risks individually.

Figure 21: Summary of analyst's recommendations

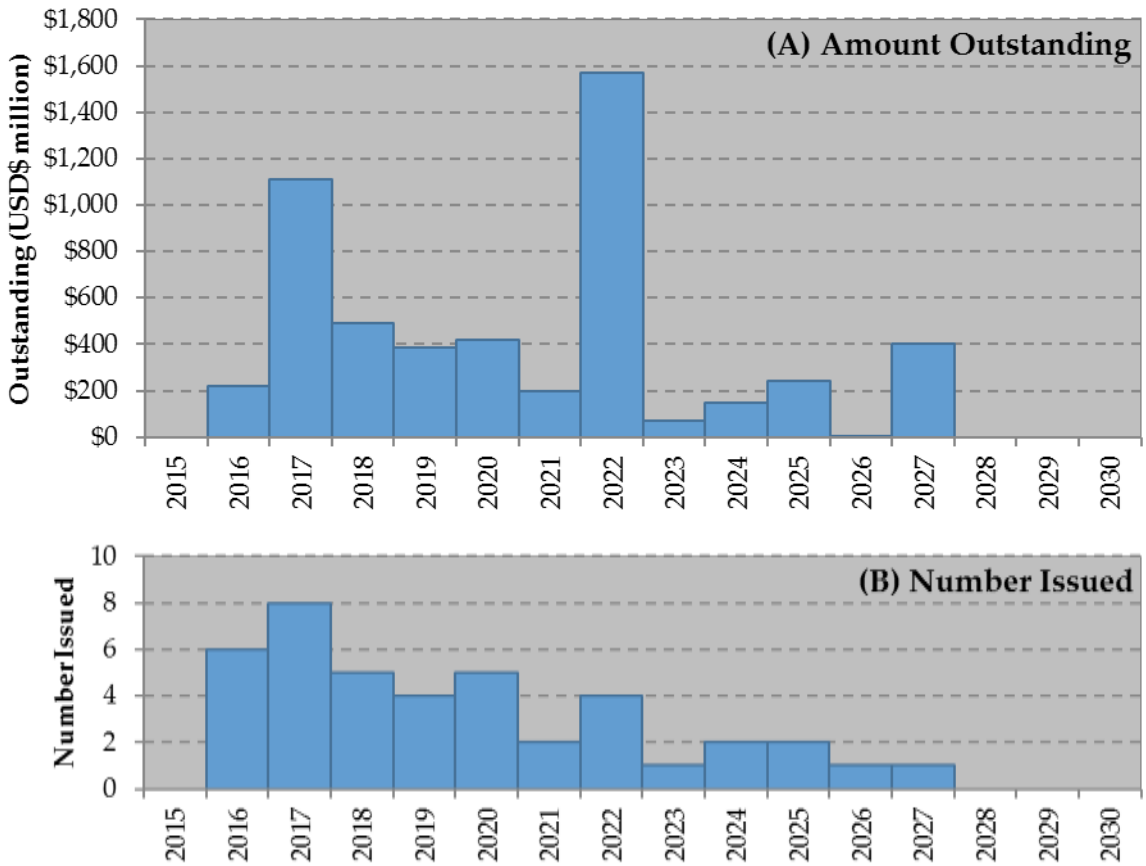


5.1.4 Bond Issuance

Figure 22 illustrates the maturity schedule for the palm oil industry. Data were available for 12 of the palm oil companies. The schedule is divided into total amount outstanding (US$) in Plot (A) and the maturity dates of various contracts in Plot (B).

Plot (A) of Figure 22 illustrates the total amount of debt due between 2015 and 2027. The majority of the debt outstanding is due prior to 2021. A large proportion of the debt borrowed must be retired in 2017. Four companies have individually borrowed between $228 and $600 million in debt until 2022; representing a period year of potential financial distress. This is not typical for the remaining companies. The number of contracts issues (Plot B) shows a large number of short-term contracts. No palm oil companies in our sample have borrowed beyond 2027. Our data show that Malaysia Airports Holdings is the only company to issue perpetual debt, with an amount outstanding of US$227.66 million.

Figure 22: Bond maturity schedule for the palm oil industry



6 Conclusions

It is difficult to predict the future state of the Indonesian palm oil sector as many factors are rapidly changing. For one, the Indonesian government has policies regarding curbing national GHG emissions, limiting foreign ownership of palm oil companies, encouraging greater processing within the country through tariffs on export of CPO, and establishing its own national sustainability certification body (e.g. ISPO). Indications are that the current president of Indonesia, Joko Widodo, will work to reduce deforestation rates and protect remaining peatland areas.[264] While 85% of these emissions reductions would need to come from changes in national land management, the palm oil sector would be a relatively small contribution. Based on an analysis looking at land-use emissions from 2000-10, a moratorium on deforestation in timber and oil palm concessions would have only reduced emissions by 15%.[265]

Therefore, Busch, et al. (2015)[266] argue that meeting the 26% GHG reduction target will be impossible focusing only new concessions. Emissions from practices on current concessions and deforestation outside of these and protected areas are noted to be of particular importance.[267] Thus, if the government wishes to reduce national GHG emissions by 26%, it is increasingly evident that consideration for deforestation occurring outside of designated forest concessions and protected areas would be essential. This would also have the co-benefit of protecting valuable habitat for a number of endangered Sumatran and Bornean species.

President Widodo has stated that he intends to tackle the entrenched political patronage system, which challenges the legitimacy of government efforts like the ISPO and deforestation moratorium. There is certainly evidence that Indonesia's judicial system is supporting that process through its ruling recognising indigenous claims to forest lands illegally claimed by the Ministry of Forestry. On the other hand, the Indonesian government's desire to reduce the proportion of foreign ownership of oil palm plantations may effectively minimise the ability of international entities to pressure the sector on ESG issues.

Costs of production are expected to increase as manual labour, related to harvesting and maintenance, represents approximately 54% of total production costs per hectare.[268] Whether companies will be able to reduce labour to land area ratios (from 1:10 ha to 1:20 ha) is unclear, but it will be necessary for investors and governments to remain vigilant that these efficiency improvements occur while respecting human rights. While demand for palm oil is expected to increase over the long term, growth in demand has slowed. Prices for CPO have remained low, limiting producer companies' ability to invest in better management systems and infrastructure. However, that may be an ideal opportunity for guaranteed CSPO premiums to attract more producers to schemes like the RSPO.

There remain large question marks around the impact of future climate changes on oil palm production. Certainly drought conditions result in reduced yields and by extension reduced company profits. At the same time, projections of climatic conditions in Southeast Asia predict increases in the intensity of rain events, temperature levels and by extension local ozone levels. Agronomic models of

[264] Carrington, "Indonesia Cracks down on Deforestation in Symbolic U-Turn."
[265] Busch et al., "Reductions in Emissions from Deforestation from Indonesia's Moratorium on New Oil Palm, Timber, and Logging Concessions."
[266] Ibid.
[267] Ibid.
[268] Ismail, Simeh, and Noor, "The Production Cost of Oil Palm Fresh Fruit Bunches: The Case of Independent Smallholders in Johor."

oil palm have not been calibrated to assess these factors in coordination; however, it seems highly likely that monthly production levels of FFB will be closely linked to specific weather events and therefore more varied throughout the year. This could have knock-on effects for processers and global volumes of palm oil, as the vast majority of CPO is produced by just Malaysia and Indonesia.

International scrutiny of the oil palm sector regarding biodiversity conservation is closely aligned to ESG concerns and consumer pressure in general. This report has outlined a large array of financial and multi-stakeholder initiatives intended to improve the sector's practices. In principle, the fact that 96% of the palm oil trade has made zero-deforestation commitments, would indicate the industry is well on its way toward a wholesale reduction of its GHG emissions. Obviously, in practice that is much more challenging to enforce, with the myriad of smaller enterprises and subsidiaries selling to the large traders and only 30% of Indonesia's actual planted area under direct management of the largest companies we identified. The organisation of the financial sector around greater ESG monitoring should also influence the behaviour of the largest multinational palm oil companies. Again, this will need greater vigilance of actual management activities at the plantation and community level, which will need to go beyond what desk-based assessments tools such as SPOTT or the RSPO have traditionally provided.

However, while the RSPO has been attempting to show stricter enforcement of its principles and criteria a number of other NGOs are providing important oversight of the industry. Between the Global Forest Watch's regularly updated medium resolution satellite imagery, BankTrack's following of financial backers of the palm oil sector and its ESG infractions and Chain Reaction Research's producing detailed reports of environmentally intensive commodity companies; there are resources available for interested investors to follow the performance of specific companies. This may be the new normal until the Indonesian government is able or willing to provide adequate oversight of the sector, which key financial actors are increasingly expecting.

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Appendix A Summary of SPOTT and Financial Statements

Company Name	Landbank (ha)	SPOTT Score	Rev from Palm	Revenue	Net Income	Market Cap	Total Assets	Total Debt	Total Equity	Float
Golden Agri-Resources Ltd	451,084	67.86%	79.30%	$7,619.31	$113.55	$4,457.62	$14,666.62	$5,848.30	$8,818.32	50.00%
PT Salim Ivomas Pratama	398,000	50.98%	64.60%	$1,208.14	$68.01	$882.39	$2,502.71	$1,145.66	$1,357.05	20.00%
PT Astra Agro Lestari Tbk	-	28.57%	100.00%	$1,316.58	$202.16	$3,083.38	$1,498.46	$542.66	$955.79	20.30%
Indofood Agri Resources Ltd.	-	-	-	$1,208.14	$61.26	$775.63	$3,242.20	$1,327.21	$1,914.99	27.80%
First Resources Limited	172,668	41.07%	44.80%	$615.52	$173.41	$2,236.04	$1,997.86	$882.11	$1,115.75	35.70%
Genting Plantations Berhad	245,504	28.57%	76.90%	$469.88	$107.89	$2,203.14	$1,598.86	$411.06	$1,187.80	43.40%
Wilmar International Limited	242,615	57.14%	2.90%	$43,084.88	$1,156.18	$15,641.15	$43,558.16	$27,147.36	$16,410.80	27.60%
Bumitama Agri Ltd.	199,000	33.93%	100.00%	$464.86	$93.10	$1,386.38	$1,114.52	$540.54	$573.98	17.60%
PT Austindo Nusantara Jaya Tbk.	164,302	30.36%	100.00%	$158.33	$18.43	$356.62	$444.03	$68.57	$375.46	6.60%
PT Sinar Mas Agro Resources & Technology Tbk	-	-	-	$2,611.28	$119.06	$1,878.47	$1,719.26	$1,077.66	$641.60	2.80%
PT Perusahaan Perkebunan London Sumatra Indonesia Tbk	107,000	44.64%	92.30%	$381.63	$74.02	$1,040.76	$698.84	$115.97	$582.87	40.50%
Kuala Lumpur Kepong Berhad	270,040	42.86%	47.20%	$3,392.77	$302.30	$6,944.44	$3,928.55	$1,434.05	$2,494.50	48.30%
R.E.A. Holdings plc	60,000	62.50%	100.00%	$125.87	$22.29	$190.66	$608.69	$302.06	$306.63	68.70%
IOI Corp.Bhd	226,000	56.86%	67.00%	$3,708.73	$1,050.29	$8,732.47	$4,773.97	$2,833.10	$1,940.87	50.10%
Société Internationale de Plantations et de Finance	92,933	52.94%	82.80%	$285.90	$56.27	$513.06	$754.58	$171.23	$583.35	60.10%
Kulim (Malaysia) Berhad	91,805	57.14%	-	$312.79	$46.99	$1,138.98	$2,647.95	$1,042.72	$1,605.23	36.60%
Felda Global Ventures Holdings Berhad	741,480	44.64%	35.80%	$4,681.62	$93.09	$2,274.55	$5,926.91	$3,403.31	$2,523.60	60.50%
Société Financière des Caoutchoucs Société Anonyme	-	-	-	$694.24	$63.45	$551.57	$2,608.58	$837.23	$1,771.36	15.20%
United Plantations Bhd	45,421	62.50%	42.90%	$292.25	$79.52	$1,450.06	$667.45	$59.15	$608.30	43.60%
Hap Seng Plantations Holdings Bhd	39,803	46.00%	100.00%	$141.73	$36.70	$574.08	$630.65	$73.65	$557.00	31.10%
Keck Seng Malaysia Bhd	-	25.93%	77.30%	$310.75	$37.10	$541.83	$734.22	$113.48	$620.74	36.70%
Boustead Plantations Berhad	83,400	25.00%	100.00%	$205.15	$16.35	$663.52	$944.58	$272.92	$671.66	38.70%
IJM Plantations Berhad	64,112	19.64%	100.00%	$198.19	$27.15	$911.68	$681.81	$258.47	$423.34	34.40%
QL Resources Berhad	16,200	10.71%	12.70%	$752.70	$48.99	$1,177.89	$686.67	$274.44	$412.23	38.20%
Jaya Tiasa Holdings Berhad	83,483	7.14%	32.00%	$321.76	$16.54	$559.23	$938.01	$391.48	$546.53	32.10%
Sarawak Oil Palms Bhd	72,653	7.14%	100.00%	$822.17	$33.01	$648.60	$777.90	$369.23	$408.67	32.90%
TSH Resources Berhad	123,200	7.55%	90.50%	$306.32	$35.40	$888.86	$740.66	$371.81	$368.85	63.40%
Malaysia Airports Holdings Bhd	-	1.79%	2.10%	$956.31	$213.99	$2,672.45	$6,443.63	$4,320.89	$2,122.74	61.90%
Anglo Eastern Plantations plc	128,000	10.71%	100.00%	$251.26	$30.76	$342.84	$633.58	$115.53	$518.05	43.80%
Asian Agri	93,791	51.79%	-	-	-		-	-	-	-

PT Bakrie Sumatera Plantations Tbk	154,464	25.00%	79.20%	$212.90	-$50.45	$55.39	$1,408.29	$1,072.87	$335.42	86.10%
Darmex Agro, Pt	-	0.00%	-	-	-		-	-	-	-
PT Eagle High Plantations Tbk	425,000	14.29%	25.60%	$182.83	$15.30	$1,018.18	$1,322.56	$761.66	$560.90	29.40%
Glenealy Plantations Malaya Bhd	68,679	3.57%	-	-	-		-	-	-	-
Kencana Agri Limited	193,570	16.04%	100.00%	$176.50	$7.22	$173.32	$511.00	$338.26	$172.74	22.00%
P.T. Musim Mas	212,538	65.18%	-	-	-		-	-	-	-
PT Sampoerna Agro Tbk	128,000	19.64%	97.90%	$261.80	$27.48	$320.47	$441.41	$197.78	$243.63	23.60%
Sime Darby Berhad	995,538	66.07%	21.70%	$13,672.12	$1,043.97	$15,938.55	$15,860.56	$6,685.63	$9,174.93	45.10%
PT Tiga Pilar Sejahtera Food Tbk	51,199	4.72%	3.90%	$415.02	$26.79	$567.28	$595.22	$305.13	$290.10	49.00%
Tradewinds Plantation Berhad	160,000	3.57%	-	-	-		-	-	-	-
PT Triputra Agro Persada	388,000	5.36%	-	-	-		-	-	-	-
PT Tunas Baru Lampung Tbk	75,000	16.07%	77.50%	$511.71	$35.00	$300.91	$591.72	$392.73	$198.98	45.60%
Socfinasia SA	214,078	34.82%	100.00%	$206.73	$77.11	$470.22	$1,163.41	$277.93	$885.48	100.00%
PT Sawit Sumbermas Sarana Tbk	-	-	-	$176.07	$58.06	$1,280.51	$325.63	$83.03	$242.60	29.40%
Chin Teck Plantations Berhad	-	-	-	$37.72	$11.43	$242.49	$201.65	$5.60	$196.05	8.30%
PT Gozco Plantations Tbk	-	-	-	$37.37	$4.26	$65.40	$261.01	$135.51	$125.50	39.50%
PT Provident Agro Tbk	-	-	-	$85.39	$13.59	$275.93	$341.03	$205.34	$135.69	55.70%
PT Jaya Agra Wattie Tbk	-	-	-	$61.41	$4.08	$115.21	$247.27	$141.04	$106.23	29.00%
TDM Berhad	-	-	-	$110.43	$16.20	$351.72	$599.91	$216.86	$383.06	34.80%
Total	6,983,881	-	-	$93,047.06	$5,687.30	$85,893.93	$132,040.58	$66,571.22	$65,469.37	-
Median	154,464	28.57%	79.20%	$317.28	$47.99	$829.01	$857.96	$370.52	$578.43	36.70%

Appendix B Location, Geographical Segments, and Corporate Parents

Company Name	Country (Main HQ)	1st Geo Segment	2nd Geo. Segment	3rd Geo. Segment	Ticker	Ultimate Corporate Parent	Public or Private*
Golden Agri-Resources Ltd	Singapore	China	Indonesia	India	SGX:E5H	Golden Agri-Resources Ltd	Public
PT Salim Ivomas Pratama	Indonesia	Indonesia	Singapore	China	JKSE:SIMP	First Pacific Company Limited	Public
PT Astra Agro Lestari Tbk	Indonesia	Indonesia	Sumatra	Kalimantan	JKSE:AALI	Jardine Matheson Holdings Limited	Public
Indofood Agri Resources Ltd.	Singapore	Indonesia	Singapore	China	SGX:5JS	First Pacific Company Limited	Public
First Resources Limited	Singapore	Singapore	Indonesia	-	SGX:EB5	First Resources Limited	Public
Genting Plantations Berhad	Malaysia	Malaysia	Indonesia	-	KLSE:GENP	Genting Berhad	Public
Wilmar International Limited	Singapore	South East Asia	People's Republic of China	India	SGX:F34	Wilmar International Limited	Public
Bumitama Agri Ltd.	Indonesia	Indonesia	-	-	SGX:P8Z	Wellpoint Pacific Holdings Ltd	Private
PT Austindo Nusantara Jaya Tbk.	Indonesia	Indonesia	-	-	JKSE:ANJT	PT Austindo Nusantara Jaya Tbk.	Public
PT Sinar Mas Agro Resources & Technology Tbk	Indonesia	Indonesia	-	Java	JKSE:SMAR	Golden Agri-Resources Ltd	Public
PT Perusahaan Perkebunan London Sumatra Indonesia Tbk	Indonesia	Indonesia	-	-	JKSE:LSIP	First Pacific Company Limited	Public
Kuala Lumpur Kepong Berhad	Malaysia	Malaysia	Far East	Middle East	KLSE:KLK	Kuala Lumpur Kepong Berhad	Public
R.E.A. Holdings plc	United Kingdom	Indonesia	UK, Continental Europe and Singapore	Rest of Asia	LSE:RE.	R.E.A. Holdings plc	Public
IOI Corp.Bhd	Malaysia	Malaysia	Europe	North America	KLSE:IOICORP	IOI Corp.Bhd	Public
Société Internationale de Plantations et de Finance	Belgium	Indonesia	Papua New Guinea	Ivory Coast	ENXTBR:SIP	Société Internationale de Plantations et de Finance	Public
Kulim (Malaysia) Berhad	Malaysia	Malaysia	Indonesia	-	KLSE:KULIM	Johor Corporation	Private
Felda Global Ventures Holdings Berhad	Malaysia	Malaysia	China	Pakistan	KLSE:FGV	Felda Global Ventures Holdings Berhad	Public
Société Financière des Caoutchoucs Société Anonyme	Luxembourg	Europe	Sierra Leone	Liberia	BDL:002796783	Société Financière des Caoutchoucs Société Anonyme	Public
United Plantations Bhd	Malaysia	Malaysia	Indonesia	Europe	KLSE:UTDPLT	United Plantations Bhd	Public
Hap Seng Plantations Holdings Bhd	Malaysia	Malaysia	-	-	KLSE:HSPLANT	Gek Poh (Holdings) Sdn Bhd.	Private
Keck Seng Malaysia Bhd	Malaysia	Malaysia	Singapore	Hong Kong	KLSE:KSENG	Keck Seng Malaysia Bhd	Public
Boustead Plantations Berhad	Malaysia	Malaysia	-	-	KLSE:BPLANT	Boustead Holdings Bhd	Public
IJM Plantations Berhad	Malaysia	Malaysia	Indonesia	-	KLSE:IJMPLNT	IJM Corporation Berhad	Public
QL Resources Berhad	Malaysia	Malaysia	Indonesia	Vietnam	KLSE:QL	QL Resources Berhad	Public
Jaya Tiasa Holdings Berhad	Malaysia	Malaysia	Brazil	Other Countries	KLSE:JTIASA	Jaya Tiasa Holdings Berhad	Public
Sarawak Oil Palms Bhd	Malaysia	Malaysia	-	-	KLSE:SOP	Sarawak Oil Palms Bhd	Public

TSH Resources Berhad	Malaysia	Malaysia	Europe	USA	KLSE:TSH	TSH Resources Berhad	Public
Malaysia Airports Holdings Bhd	Malaysia	Malaysia	-	-	KLSE:AIRPORT	Malaysia Airports Holdings Bhd	Public
Anglo Eastern Plantations plc	United Kingdom	Indonesia	Malaysia	United Kingdom	LSE:AEP	Anglo Eastern Plantations plc	Public
Asian Agri	Indonesia	-	-	-	-	Asian Agri	Private
PT Bakrie Sumatera Plantations Tbk	Indonesia	Indonesia	-	-	JKSE:UNSP	PT Bakrie Sumatera Plantations Tbk	Public
Darmex Agro, Pt	Indonesia	-	-	-	-	Darmex Agro, Pt	Private
PT Eagle High Plantations Tbk	Indonesia	Sumatera & Sulawesi	Singapore	Papua	JKSE:BWPT	PT Rajawali Corporation	Private
Glenealy Plantations Malaya Bhd	Malaysia	Sabah	Sarawak	-	-	Glenealy Plantations Malaya Bhd	Private
Kencana Agri Limited	Singapore	Indonesia	Singapore	India	SGX:BNE	Kencana Holdings Pte. Ltd.	Private
P.T. Musim Mas	Indonesia	-	-	-	-	P.T. Musim Mas	Private
PT Sampoerna Agro Tbk	Indonesia	Indonesia	Malaysia	Japan	JKSE:SGRO	Sampoerna Agri Resources Pte. Ltd	Private
Sime Darby Berhad	Malaysia	Malaysia	Indonesia	Singapore	KLSE:SIME	Sime Darby Berhad	Public
PT Tiga Pilar Sejahtera Food Tbk	Indonesia	Indonesia	Greater Jakarta	Central Java	JKSE:AISA	PT Tiga Pilar Sejahtera Food Tbk	Public
Tradewinds Plantation Berhad	Malaysia	Malaysia	Singapore	South Korea	-	Tradewinds Malaysia Bhd	Private
PT Triputra Agro Persada	Indonesia	-	-	-	-	PT Triputra Agro Persada	Private
PT Tunas Baru Lampung Tbk	Indonesia	Export	Indonesia	-	JKSE:TBLA	PT Tunas Baru Lampung Tbk	Public
Socfinasia SA	Luxembourg	Europe	Cambodia	Indonesia	BDL:009204741	Socfinasia SA	Public
PT Sawit Sumbermas Sarana Tbk	Indonesia	Indonesia	-	-	JKSE:SSMS	PT Sawit Sumbermas Sarana Tbk	Public
Chin Teck Plantations Berhad	Malaysia	Malaysia	-	-	KLSE:CHINTEK	Chin Teck Plantations Berhad	Public
PT Gozco Plantations Tbk	Indonesia	Indonesia	Sumatera	Kalimantan	JKSE:GZCO	PT Gozco Plantations Tbk	Public
PT Provident Agro Tbk	Indonesia	Indonesia	Sumatera	Kalimantan	JKSE:PALM	PT Provident Agro Tbk	Public
PT Jaya Agra Wattie Tbk	Indonesia	Indonesia	-	-	JKSE:JAWA	PT Sinar Kasih Abadi	Private
TDM Berhad	Malaysia	Malaysia	Indonesia	-	KLSE:TDM	TDM Berhad	Public

* Private or Public Ownership of ultimate parent

Appendix C Ownership Structure

Company Name	Company						Ultimate Parent Company					
	Insiders	Institutions	Corporate	ESOP	State	Public/Other	Insiders	Institutions	Corporate	ESOP	State	Public/Other
Golden Agri-Resources Ltd	$0.33	$614.57	$1,528.16	-	-	$891.88	$0.36	$665.90	$1,663.07	-	-	$973.55
PT Salim Ivomas Pratama	$0.01	$13.11	$280.36	-	-	$57.00	$848.89	$1,370.77	$177.12	-	-	$534.24
PT Astra Agro Lestari Tbk	-	$69.30	$1,515.58	-	-	$317.09	$3,519.34	$6,143.67	-	-	-	$6,945.66
Indofood Agri Resources Ltd.	$0.15	$17.54	$303.75	-	-	$84.62	$848.89	$1,370.77	$177.12	-	-	$534.24
First Resources Limited	$2.59	$368.72	$14.91	-	-	$294.49	$2.72	$388.15	$15.63	-	-	$306.97
Genting Plantations Berhad	$7.43	$592.21	$1,015.01	-	$7.81	$270.16	$128.75	$3,259.02	$2,844.12	-	$46.51	$744.87
Wilmar International Limited	$1,970.60	$778.91	$5,931.79	-	-	$3,058.13	$2,119.43	$841.57	$6,379.79	-	-	$3,285.27
Bumitama Agri Ltd.	$1.35	$33.91	$706.05	-	-	$107.63	-	-	-	-	-	-
PT Austindo Nusantara Jaya Tbk.	$38.40	$4.68	$328.96	-	-	$22.00	$38.40	$4.68	$328.96	-	-	$22.00
PT Sinar Mas Agro Resources & Technology Tbk	-	$2.68	$823.16	-	-	$21.00	$0.36	$665.90	$1,663.07	-	-	$973.55
PT Perusahaan Perkebunan London Sumatra Indonesia Tbk	-	$41.76	$398.86	-	-	$229.65	$848.89	$1,370.77	$177.12	-	-	$534.24
Kuala Lumpur Kepong Berhad	$19.62	$2,053.47	$2,903.40	-	-	$691.37	$21.13	$2,206.96	$3,126.31	-	-	$748.61
R.E.A. Holdings plc	$1.94	$84.67	$37.70	-	-	$14.32	$1.95	$84.87	$37.79	-	-	$14.36
IOI Corp.Bhd	$135.79	$2,219.37	$3,184.97	-	-	$943.40	$153.49	$2,504.81	$3,599.93	-	-	$1,070.03
Société Internationale de Plantations et de Finance	-	$87.97	$189.58	-	-	$187.90	-	$87.89	$189.34	-	-	$187.63
Kulim (Malaysia) Berhad	$8.78	$326.53	$679.61	-	-	$83.77	-	-	-	-	-	-
Felda Global Ventures Holdings Berhad	$0.33	$284.80	$436.98	-	-	$499.29	$0.39	$330.32	$507.04	-	-	$579.49
Société Financière des Caoutchoucs Société Anonyme	-	-	$317.76	-	-	$56.96	-	-	$317.38	-	-	$56.89
United Plantations Bhd	$21.83	$358.88	$665.27	$13.40	-	$148.55	$22.38	$365.05	$682.18	$13.74	-	$155.28
Hap Seng Plantations Holdings Bhd	$2.00	$84.59	$292.64	-	-	$43.39	-	-	-	-	-	-
Keck Seng Malaysia Bhd	$272.80	$99.13	$6.23	-	-	$63.39	$279.74	$101.65	$6.39	-	-	$65.00
Boustead Plantations Berhad	$23.41	$103.76	$308.98	-	-	$91.39	$32.16	$730.80	$30.50	-	-	$171.16
IJM Plantations Berhad	$3.71	$179.38	$482.77	-	-	$75.42	$16.30	$1,955.24	-	-	$31.45	$956.91
QL Resources Berhad	$72.13	$182.89	$721.40	-	-	$345.60	$74.29	$188.47	$742.99	-	-	$355.84
Jaya Tiasa Holdings Berhad	$14.79	$33.86	$204.50	-	-	$70.54	$15.38	$35.26	$212.63	-	-	$73.29
Sarawak Oil Palms Bhd	$33.56	$55.94	$206.45	-	$32.22	$79.18	$35.63	$59.43	$219.21	-	$34.21	$84.04
TSH Resources Berhad	$157.05	$6.08	$75.39	-	-	$390.69	$163.46	$6.45	$78.47	-	-	$406.51
Malaysia Airports Holdings Bhd	-	$1,058.00	$14.12	-	$24.41	$259.17	-	$1,139.41	$15.10	-	$26.11	$269.54

Anglo Eastern Plantations plc	$157.83	$124.02	$1.64	-	-	$1.92	$162.15	$127.41	$1.68	-	-	$1.97
Asian Agri	-	-	-	-	-	-	-	-	-	-	-	-
PT Bakrie Sumatera Plantations Tbk	$0.79	$5.15	$6.09	-	-	$37.37	$0.79	$5.15	$6.09	$0.00	-	$37.37
Darmex Agro, Pt	-	-	-	-	-	-	-	-	-	-	-	-
PT Eagle High Plantations Tbk	$0.15	$9.75	$297.67	-	-	$114.57	-	-	-	-	-	-
Glenealy Plantations Malaya Bhd	-	-	-	-	-	-	-	-	-	-	-	-
Kencana Agri Limited	$4.02	$6.02	$59.53	-	-	$11.80	-	-	-	-	-	-
P.T. Musim Mas	-	-	-	-	-	-	-	-	-	-	-	-
PT Sampoerna Agro Tbk	-	$23.27	$183.40	-	-	$33.51	-	-	-	-	-	-
Sime Darby Berhad	$0.50	$9,036.99	$79.46	-	-	$1,579.79	$0.57	$10,345.11	$90.95	-	-	$1,806.38
PT Tiga Pilar Sejahtera Food Tbk	-	$33.64	$126.89	-	-	$83.96	-	$33.07	$124.48	-	-	$82.30
Tradewinds Plantation Berhad	-	-	-	-	-	-	-	-	-	-	-	-
PT Triputra Agro Persada	-	-	-	-	-	-	-	-	-	-	-	-
PT Tunas Baru Lampung Tbk	$0.18	$2.24	$108.58	-	-	$88.79	$0.17	$2.23	$107.54	-	-	$87.92
Socfinasia SA	-	$1.18	-	-	-	$351.06	-	$1.21	-	-	-	$358.89
PT Sawit Sumbermas Sarana Tbk	$98.49	$290.89	$696.73	-	-	$210.05	$103.44	$305.94	$731.75	-	-	$220.18
Chin Teck Plantations Berhad	$19.94	$2.22	$105.57	-	-	$36.77	$20.45	$2.28	$108.25	-	-	$37.71
PT Gozco Plantations Tbk	$1.81	$11.46	$9.31	-	-	$10.24	$1.83	$11.61	$9.43	-	-	$10.37
PT Provident Agro Tbk	$0.28	$94.89	-	-	-	$24.81	$0.28	$96.21	-	-	-	$25.15
PT Jaya Agra Wattie Tbk	$0.25	$0.24	$38.51	-	-	$15.62	-	-	-	-	-	-
TDM Berhad	$0.96	$42.08	$38.59	-	$1.82	$1.70	$1.01	$44.39	$40.79	-	$1.93	$1.89
TOTAL	**$3,274.35**	**$21,584.53**	**$26,956.16**	**$13.74**	**$71.11**	**$12,963.83**	**$9,462.99**	**$36,852.40**	**$24,412.21**	**$13.74**	**$140.21**	**$22,719.30**

Appendix D Inter-Temporal Financial Ratio Analysis for the Sample

Year	Count	Gross margin	Net income margin	CAPEX/Revenue	Current ratio	Quick ratio	Debt/equity	Debt/capital	EBIT/Interest	EBITDA/Interest	(EBITDA-CAPEX)/Interest	Total Debt/EBITDA	Net Debt/EBITDA	Total Debt/(EBITDA-CAPEX)	Net Debt/(EBITDA-CAPEX)	Return on Equity	Return on Assets	Altman's Z	Analyst's Recommendations
1990	6	30.33%	19.74%	-	1.36	0.81	13.48%	11.59%	11.46	13.62	13.62	1.14	1.07	1.14	1.07	-	-	-	-
1991	6	20.39%	12.83%	-	1.41	0.99	17.88%	14.65%	5.57	7.09	7.09	1.93	2.11	1.93	2.11	5.57%	3.50%	-	-
1992	7	22.38%	11.05%	-	0.86	0.77	26.40%	20.89%	4.92	6.42	6.42	1.79	1.65	1.79	1.65	5.85%	3.61%	-	-
1993	8	23.57%	11.01%	-	0.97	0.75	7.41%	6.89%	9.98	12.86	12.86	0.49	1.21	0.49	1.21	7.15%	4.45%	-	-
1994	9	25.64%	11.52%	-	1.20	0.72	10.62%	9.60%	19.62	22.21	22.21	0.57	1.89	0.57	1.89	7.30%	4.44%	-	-
1995	12	28.25%	15.18%	13.10%	1.42	0.86	9.25%	8.46%	16.31	19.82	14.59	0.49	1.33	0.87	3.63	8.33%	5.65%	-	-
1996	15	33.21%	29.40%	9.33%	1.62	1.28	10.35%	9.38%	12.52	17.19	9.40	0.40	0.87	0.72	2.07	12.71%	7.55%	1.50	2.92
1997	18	34.74%	18.52%	13.56%	1.70	1.01	8.34%	7.70%	8.99	10.52	9.68	1.11	1.61	1.50	1.81	13.05%	6.50%	1.52	2.92
1998	21	33.28%	17.71%	11.63%	1.18	0.89	49.01%	32.89%	8.43	10.55	6.20	2.76	3.81	2.67	8.24	12.05%	7.27%	1.65	2.34
1999	21	33.84%	9.94%	7.66%	1.34	0.91	53.54%	37.82%	4.64	5.24	2.61	1.43	2.82	4.03	4.72	10.84%	6.63%	1.75	2.51
2000	21	36.43%	12.41%	8.04%	1.52	0.76	45.77%	43.07%	8.05	11.68	9.74	2.15	2.43	2.21	5.26	17.07%	6.36%	1.93	3.41
2001	23	28.74%	6.46%	13.36%	1.12	0.86	39.58%	28.77%	5.29	7.57	4.40	2.84	3.59	2.65	12.35	5.03%	3.66%	2.33	2.73
2002	23	29.09%	4.12%	12.42%	1.03	0.73	37.78%	28.34%	4.89	7.33	6.98	3.26	3.46	3.27	9.45	2.76%	2.95%	1.77	2.76
2003	25	36.20%	11.29%	9.78%	1.21	0.93	31.78%	28.09%	5.59	9.11	5.46	2.03	1.83	4.06	5.05	8.46%	5.29%	1.63	2.50
2004	26	34.30%	9.74%	9.72%	1.63	1.22	37.80%	27.41%	5.90	9.82	3.83	2.07	2.10	5.11	4.64	10.52%	6.88%	1.51	2.88
2005	26	34.53%	13.24%	8.95%	1.53	1.16	32.13%	26.10%	10.15	12.41	7.52	1.58	1.85	2.49	4.47	11.95%	6.99%	2.21	2.76
2006	29	30.64%	12.56%	9.62%	1.65	1.03	32.94%	25.56%	7.68	9.75	6.14	1.94	2.31	2.70	4.62	10.04%	5.53%	2.06	2.00
2007	32	34.66%	13.97%	11.79%	1.52	0.89	34.68%	26.00%	6.75	8.69	5.81	1.98	1.83	2.69	3.80	14.44%	5.61%	2.59	2.20
2008	35	39.83%	18.94%	10.30%	1.77	1.23	34.80%	25.82%	13.30	14.50	8.88	1.38	1.20	1.65	2.66	16.46%	7.94%	2.51	1.92
2009	36	34.70%	18.80%	13.45%	1.89	1.27	32.57%	24.55%	11.00	13.11	9.67	1.32	1.40	2.01	2.79	16.94%	9.58%	2.82	2.73
2010	39	33.72%	16.28%	19.11%	1.83	1.12	44.13%	30.62%	9.21	12.51	6.37	2.08	2.09	4.19	5.48	13.96%	5.85%	2.02	2.68
2011	36	39.63%	20.50%	14.78%	2.05	1.33	49.55%	33.09%	11.37	14.52	7.83	2.27	2.14	3.92	4.59	15.13%	7.36%	2.18	1.90
2012	36	38.81%	21.82%	15.21%	1.87	1.27	42.31%	29.73%	11.23	13.60	13.47	1.86	1.84	2.88	2.54	17.32%	8.66%	2.45	1.94
2013	39	35.38%	11.77%	18.44%	1.86	1.11	46.49%	31.74%	9.46	11.38	7.58	2.19	2.28	4.47	3.51	10.06%	5.42%	2.54	2.12
2014	39	29.20%	9.84%	22.58%	1.25	0.76	62.29%	38.38%	7.56	9.65	6.99	3.52	3.38	6.48	5.43	7.15%	3.59%	2.16	2.78
2015	40	29.65%	11.56%	19.50%	1.22	0.76	55.99%	35.89%	7.06	9.27	3.60	3.44	2.93	10.39	9.42	8.96%	4.63%	2.29	2.26

Appendix E Financial Ratio Analysis at the Firm-Level

Company Name	Gross Margin	Net Income Margin	Quick ratio	Current Ratio	Debt/Equity	Debt/Capital	EBIT/Interest	EBITDA/Interest	(EBITDA-CAPEX)/Interest	Total Debt/EBITDA	Total Debt/(EBITDA-CAPEX)	Net Debt/EBITDA	Net Debt/(EBITDA-CAPEX)	Return on Equity	Return on Assets	Altman Z	CAPEX/Revenue
Golden Agri-Resources Ltd	17.05%	1.49%	0.45	1.12	37.60%	27.33%	3.17	4.40	0.66	6.32	42.46	5.33	35.81	132.81%	163.74%	1.85	5.86%
PT Salim Ivomas Pratama	27.23%	5.63%	0.53	0.87	56.37%	36.05%	3.50	4.99	0.36	2.72	38.05	1.95	27.22	674.07%	516.78%	1.66	21.62%
PT Astra Agro Lestari Tbk	30.37%	15.35%	0.16	0.58	37.40%	27.22%	48.12	58.17	15.78	0.98	3.63	0.85	3.13	2,371.62%	1,388.04%	5.73	20.10%
Indofood Agri Resources Ltd.	29.05%	5.07%	0.67	0.98	43.87%	30.49%	3.62	4.72	0.12	2.98	121.78	1.95	79.81	570.63%	430.80%	1.39	22.80%
First Resources Limited	52.54%	28.17%	3.74	5.38	52.26%	34.32%	13.37	14.79	4.13	1.96	7.02	0.98	3.51	1,677.19%	890.16%	3.56	34.86%
Genting Plantations Berhad	41.56%	22.96%	3.82	4.49	24.78%	19.86%	42.39	49.14	16.34	1.84	5.55	-	-	989.48%	576.12%	5.05	22.67%
Wilmar International Limited	8.86%	2.68%	0.76	1.28	136.41%	57.70%	2.98	4.24	2.15	10.09	19.90	5.86	11.55	757.89%	215.92%	1.91	2.54%
Bumitama Agri Ltd.	40.67%	20.03%	0.30	0.70	60.21%	37.58%	18.85	20.58	3.92	1.98	10.37	1.83	9.61	2,070.71%	967.07%	2.94	30.45%
PT Austindo Nusantara Jaya Tbk.	40.33%	11.61%	0.77	1.22	7.45%	6.93%	68.69	99.83	2.54	0.53	20.61	-	-	493.65%	544.02%	4.72	32.69%
PT Sinar Mas Agro Resources & Technology Tbk	14.18%	4.56%	0.40	1.08	121.43%	54.84%	7.26	8.97	2.86	3.66	11.50	3.05	9.57	2,043.72%	671.51%	3.14	5.55%
PT Perusahaan Perkebunan London Sumatra Indonesia Tbk	34.62%	19.39%	1.93	2.49	-	-	353.03	432.89	172.30	-	-	-	-	1,325.39%	938.55%	7.86	19.50%
Kuala Lumpur Kepong Berhad	19.07%	8.91%	1.21	2.01	35.57%	26.24%	16.11	19.89	8.87	1.67	3.76	0.93	2.08	1,279.95%	714.05%	5.27	8.65%
R.E.A. Holdings plc	36.75%	17.71%	0.36	0.67	64.06%	39.05%	2.22	2.97	0.38	5.14	40.62	4.50	35.60	725.36%	294.97%	1.30	26.55%
IOI Corp.Bhd	22.54%	28.32%	1.47	2.11	121.89%	54.93%	6.65	7.44	6.28	3.61	4.29	1.67	1.98	1,252.15%	598.39%	4.16	2.77%
Société Internationale de Plantations et de Finance	29.53%	19.68%	0.72	1.11	8.96%	8.22%	69.27	88.05	27.66	0.70	2.22	0.33	1.05	1,069.53%	505.30%	-	17.97%
Kulim (Malaysia) Berhad	24.62%	15.02%	0.19	1.81	21.42%	17.64%	2.51	4.69	-	4.65	-	3.22	-	114.57%	97.75%	1.49	46.96%
Felda Global Ventures Holdings Berhad	12.95%	1.99%	1.18	1.66	106.35%	51.54%	4.74	7.04	2.57	7.27	19.91	4.48	12.27	639.77%	261.27%	1.92	5.00%
Société Financière des Caoutchoucs Société Anonyme	62.74%	9.14%	1.05	1.42	13.90%	12.21%	14.60	18.63	-	1.61	-	0.51	-	776.00%	312.05%	0.89	22.95%
United Plantations Bhd	59.89%	27.21%	10.48	11.85	0.04%	0.04%	10,321.06	11,521.34	8,865.41	-	-	-	-	1,292.99%	872.86%	18.16	8.32%
Hap Seng Plantations Holdings Bhd	46.26%	25.89%	3.42	4.18	-	-	-	-	-	-	-	-	-	662.85%	503.36%	5.82	9.83%
Keck Seng Malaysia Bhd	20.58%	11.94%	8.86	10.83	12.13%	10.82%	44.51	55.16	-	1.84	-	-	-	596.83%	299.29%	5.42	25.48%
Boustead Plantations Berhad	57.56%	7.97%	0.61	0.66	36.54%	26.76%	2.42	3.16	1.88	5.09	8.54	2.53	4.25	276.07%	246.30%	2.17	9.48%
IJM Plantations Berhad	34.25%	13.70%	1.96	2.52	44.22%	30.66%	22.65	30.03	1.62	3.62	67.14	1.57	29.20	598.15%	364.63%	2.91	24.71%
QL Resources Berhad	16.45%	6.51%	0.90	1.57	48.62%	32.71%	6.46	8.70	3.21	2.19	5.93	1.31	3.53	1,446.66%	651.93%	4.12	7.66%

Jaya Tiasa Holdings Berhad	23.78%	5.14%	0.27	0.49	47.33%	32.12%	4.11	7.01	-	5.02	-	4.47	-	320.04%	203.36%	1.74	26.36%
Sarawak Oil Palms Bhd	12.67%	4.01%	0.90	1.35	65.20%	39.47%	5.59	8.20	3.70	3.15	7.00	1.50	3.33	895.78%	485.29%	3.13	5.65%
TSH Resources Berhad	33.56%	11.56%	0.26	0.59	80.38%	44.56%	12.22	15.19	-	4.56	-	4.31	-	1,110.75%	463.13%	2.21	25.55%
Malaysia Airports Holdings Bhd	52.63%	22.38%	0.73	0.78	89.26%	47.16%	1.58	4.21	3.68	10.22	11.69	7.06	8.08	1,236.70%	92.00%	0.72	2.45%
Anglo Eastern Plantations plc	34.46%	12.24%	4.48	4.73	6.74%	6.32%	39.12	42.50	17.86	0.41	0.97	-	-	764.73%	795.31%	4.45	19.80%
Asian Agri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT Bakrie Sumatera Plantations Tbk	27.71%	-23.70%	0.06	0.34	248.85%	71.33%	0.34	0.64	0.34	27.50	52.17	27.36	51.89	-1,130.64%	69.30%	-0.32	6.74%
Darmex Agro, Pt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT Eagle High Plantations Tbk	27.78%	8.37%	0.25	0.52	105.67%	51.38%	2.55	5.00	-	10.57	-	10.04	-	424.08%	189.28%	0.91	33.57%
Glenealy Plantations Malaya Bhd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kencana Agri Limited	22.55%	4.09%	0.20	0.55	139.60%	58.26%	2.02	2.57	-	7.50	-	7.06	-	448.03%	317.02%	1.15	23.00%
P.T. Musim Mas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT Sampoerna Agro Tbk	26.79%	10.50%	0.43	0.80	56.02%	35.91%	8.82	12.38	-	2.10	-	1.86	-	1,224.99%	717.43%	2.36	33.31%
Sime Darby Berhad	23.49%	7.64%	0.96	2.04	38.50%	27.80%	8.52	11.30	7.35	2.42	3.72	1.47	2.25	1,133.96%	444.74%	3.47	3.73%
PT Tiga Pilar Sejahtera Food Tbk	20.21%	6.46%	1.72	2.66	85.83%	46.19%	3.95	4.59	1.89	4.09	9.93	2.47	6.01	1,270.62%	654.81%	2.61	8.64%
Tradewinds Plantation Berhad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT Triputra Agro Persada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PT Tunas Baru Lampung Tbk	20.31%	6.84%	0.49	1.10	137.90%	57.97%	3.85	4.93	1.16	3.34	14.16	2.82	11.95	2,048.16%	734.08%	1.88	12.27%
Socfinasia SA	95.16%	37.30%	2.51	3.35	-	-	2,718.84	2,941.07	2,174.48	-	-	-	-	1,047.02%	438.70%	1.95	10.39%
PT Sawit Sumbermas Sarana Tbk	52.86%	32.98%	3.29	4.52	22.86%	18.61%	11.32	12.93	11.67	0.65	0.72	-	-	2,773.34%	1,496.63%	8.87	4.71%
Chin Teck Plantations Berhad	53.36%	30.30%	21.42	21.69	-	-	-	-	-	-	-	-	-	581.37%	390.53%	31.60	5.64%
PT Gozco Plantations Tbk	29.65%	11.39%	0.45	0.88	97.03%	49.25%	0.41	1.07	0.52	9.35	19.23	8.72	17.93	333.64%	119.87%	0.73	17.90%
PT Provident Agro Tbk	33.97%	15.91%	0.70	0.86	121.00%	54.75%	1.61	1.83	-	7.70	-	7.05	-	1,038.52%	349.62%	1.08	52.74%
PT Jaya Agra Wattie Tbk	28.38%	6.64%	0.26	0.53	109.72%	52.32%	1.98	2.93	-	6.48	-	6.15	-	399.11%	329.87%	1.02	56.27%
TDM Berhad	43.63%	14.67%	0.91	1.22	34.11%	25.43%	39.98	63.82	-	4.96	-	4.10	-	419.52%	186.31%	1.69	44.63%

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