BIROn - Birkbeck Institutional Research Online

Oppenheimer, P. and Clarke, E. and Cupit, O. and Delabre, Izabela and Dodson, A. and Guindon, M. and Hatto, A. and Lam, J. and Lawrence, L. and Melot, C. and Spencer, E. and Wainwright-Déri, E. and Freeman, I. and Hoffmann, M. (2021) The SPOTT Index: a proof-of-concept measure for tracking public disclosure in the Palm Oil industry. Current Research in Environmental Sustainability 3 , p. 100042. ISSN 2666-0490.

Current Research in Environmental Sustainability 3 (2021) 100042

Contents lists available at ScienceDirect

Current Research in Environmental Sustainability

journal homepage: www.elsevier.com/locate/crsust

The SPOTT index: A proof-of-concept measure for tracking public disclosure in the palm oil industry

Philippa Oppenheimer [a,*], Elizabeth Clarke [b,c,1], Oliver Cupit [b], Izabela Delabre [b,d,1], Annabelle Dodson [b], Michael Guindon [b,c,1], Alexis Hatto [b], Joyce Lam [b,e,1], Leonie Lawrence [b,f,1], Clara Melot [b], Eleanor Spencer [b], Ezster Wainwright-Déri [b,g,1], Robin Freeman [c,h], Michael Hoffmann [b]

[a] University College London, United Kingdom
[b] Conservation and Policy, Zoological Society of London, London NW1 4RY, United Kingdom
[c] WWF Singapore, 354 Tanglin Road #02-11, Tanglin International Centre, Singapore
[d] Birkbeck, University of London, Department of Geography, 32 Tavistock Square, London WC1H 9EZ, United Kingdom
[e] Better Cotton Initiative, Unit 4, 27 Corsham Street, Hoxton, London N1 6DR, United Kingdom
[f] WCS, 2 Science Park Drive #01-03, Ascent, Singapore
[g] London Borough of Lewisham, London SE13 7EZ, United Kingdom
[h] Institute of Zoology, Zoological Society of London, London NW1 4RY, United Kingdom

ARTICLE INFO

Article history:
Received 30 November 2020
Received in revised form 30 March 2021
Accepted 12 April 2021
Available online xxxx

Keywords:
Palm oil
Corporate disclosure
SPOTT index
Assessment
Companies
ESG

ABSTRACT

The production of palm oil has considerable implications for tropical biodiversity. Increasing the environmental, social and governance (ESG) transparency and disclosure of the industry will contribute towards sustainable consumption and production practices. Here, we present a method for producing an index to measure changes in ESG disclosure in the palm oil sector over time based on data collected on SPOTT (Sustainability Policy Transparency Toolkit). The SPOTT Index is based on the number of points scored by a company during an annual assessment, and the number of companies that were included in that assessment time period. The SPOTT Index shows that ESG disclosure of palm oil companies measured improved between 2014 and 2018. Although we demonstrate proof of concept based on a limited number of companies, continued growth of SPOTT will enable the production of a powerful metric in ESG disclosure beyond palm oil and also serve to incentivise sustainable production and consumption in the sector.

1. Introduction

Meeting the demands of a global population that is growing towards 10 billion people, whilst maintaining the long-term viability of the natural world, presents one of the biggest challenges of the twenty-first century (Foley et al., 2005; Foley et al., 2011). Increasing consumption associated with human population growth has placed unprecedented pressure on agricultural systems; 2005 production levels will need to increase by 100 to 110% by 2050 to meet demand (Tilman et al., 2011). Some of this demand will be met by intensification of farming practises and brownfield redevelopment, but land clearing for the expansion of existing croplands will also be required (Godfray et al., 2010). In the latter half of the twentieth century, expansion of the world's agricultural land occurred predominantly in developing countries, with total agricultural land between 1980 and 2000 increasing by 629 million hectares, whereas developed countries saw a 335 million hectare decline over the same time period (Alexandratos, 1999; Gibbs et al., 2010). Forest-rich tropical countries such as Malaysia and Indonesia have seen large-scale land acquisition and conversion to meet growing global agricultural demand. This has been enabled by processes of deregulation, weak enforcement and corruption (Johnston and Holloway, n.d.; Pittman et al., 2013).

* University College London, Gower Street, London, WC1E 6BT, United Kingdom
E-mail addresses: philippa.oppenheimer.18@alumni.ucl.ac.uk (P. Oppenheimer), eclarke@wwf.panda.org (E. Clarke), Oliver.Cupit@zsl.org (O. Cupit), i.delabre@bbk.ac.uk (I. Delabre), Annabelle.Dodson@zsl.org (A. Dodson), mguindon@wwf.sg (M. Guindon), alexishatto@gmail.com (A. Hatto), joyce.lam@bettercotton.org (J. Lam), llawrence@wcs.org (L. Lawrence), Clara.Melot@zsl.org (C. Melot), Eleanor.Spencer@zsl.org (E. Spencer), d_eszter@yahoo.com (E. Wainwright-Déri), Robin.Freeman@ioz.ac.uk (R. Freeman), mike.hoffmann@zsl.org (M. Hoffmann).
[1] Current institutional address

http://dx.doi.org/10.1016/j.crsust.2021.100042

Agricultural activity is responsible for around 86% of the deforestation in sub-tropical and tropical regions. Of this, nearly half has been driven by demand for commodities such as soy and palm oil, with much of this production occurring in Latin America and Southeast Asian countries (Bager et al., 2020; Kastner et al., 2014; Kissinger et al., 2012). The vast majority of the world's traded palm oil is produced by two countries, Indonesia and Malaysia, collectively producing 90% (Henders et al., 2015). This level of production has led to the expansion of oil palm cropland by companies at the expense of intact forests (Potapov et al., 2017), often resulting in significant attention from environmental NGOs due to a multitude of sustainability impacts. For example, the epicentre of palm oil production is Borneo, with 8.3 million hectares of plantations (Gaveau et al., 2016). During the 1973 to 2015 period, land clearing for these plantations in Malaysian Borneo accounted for 57–60% of all deforestation in this region. Meanwhile, Indonesian Borneo saw the loss of forest area averaging 350,000 ha annually between 2001 and 2016 (Gaveau et al., 2016; Gaveau, 2017).

As vegetable oils are one of the world's fastest growing commodities, demand is expected to be double that of 2008 by 2050, requiring production growth of 3.6% annually to meet this need (Byerlee et al., 2017). This growth is likely to lead to further deforestation. Moreover, the effects of deforestation due to cropland expansion are compounded by agriculture, as a whole, being one of the most dominant forces behind several environmental threats: climate change, soil and water pollution, and the significant loss of biodiversity (Foley et al., 2005; Pimm and Raven, 2000). As land in the traditional palm oil production areas becomes increasingly scarce, the negative consequences of palm oil cultivation will increasingly be seen in high-forest-cover countries such as Brazil and Western and Central Africa (Feintrenie, 2014; Villela et al., 2014).

Tropical forests are the most biodiverse terrestrial habitats, containing 50% of the world's total species (Dirzo and Raven, 2003). However, the conversion of tropical primary and secondary forest in Asia into plantations is having devastating impacts on this biodiversity (Fitzherbert et al., 2008). Available evidence indicates that the Asia-Pacific region, which includes Indonesia and Malaysia, has suffered an average animal population loss of 45% between 1970 and 2016 (Grooten and Almond, 2018). Studies have shown palm oil plantations to be a major cause of biodiversity declines (Foster et al., 2011; Maddox, 2007; Wearn et al., 2016); indeed, the substantial impact of palm oil plantations on biodiversity has been a contributing factor in the rate of species decline in Indonesia, which over the past four decades has been twice as fast as in any other country (Rodrigues et al., 2014). Biodiversity loss is not the only consequence of land use change due to palm oil production and expansion. Further environmental and social implications are also observed, such as the emission of greenhouse gases, freshwater pollution, forest fires, human rights abuses and land tenure conflicts (Colchester et al., 2006; Wicke et al., 2008).

In 2015, the United Nations developed the Sustainable Development Goals (SDGs). These 17 ambitious goals set out to end poverty by improving health and education, reducing inequality, and spurring economic growth – all whilst addressing climate change and ensuring the preservation of oceans and forests (Lee et al., 2016). Palm oil could play an important role in the process of meeting these goals; as an economically important crop, oil palm has the potential to act as a major force in poverty alleviation and rural development in the tropics (Basiron, 2007; Meijaard et al., 2020). However, the severe threats that its production poses to the Earth's biodiversity and ecosystem services and the potential for wider social implications, and how and where palm oil is produced will determine its contribution towards meeting these goals (Foley et al., 2005). Nevertheless, oil palm is also considered a highly productive and efficient crop, providing 6 to 10 times more oil per hectare than other major oil crops (Murphy, 2014). As such, due to the lower overall land use required, redirecting global demand towards more sustainable sources of palm oil could be more successful in mitigating the social and biodiversity impacts than increasing production of other crops, ultimately potentially displacing these issues to other geographies (Meijaard et al., 2018).

Schemes such as the Roundtable on Sustainable Palm Oil (RSPO) currently work to promote the growth and use of sustainable palm oil through co-operation within the supply chain and among its stakeholders (RSPO, 2018). To be certified as producing Certified Sustainable Palm Oil, producer companies must adhere to the RSPO's Principles and Criteria, against which they are audited annually and assessed for re-certification every 5 years. Transparency and disclosure forms a prominent part of the criteria for RSPO certification, with all companies required to make management documents publicly accessible to stakeholders (RSPO, 2018). This allows for greater understanding of the day-to-day running of companies, and for NGOs and other stakeholders to hold certified companies accountable (Tan et al., 2009). However, as of 2021, the RSPO only certifies 19% of the global palm oil sector, and there remains a need to ensure that transparency and disclosure within the whole sector is increasing, not just companies that are currently assessed by the RSPO (RSPO, 2021).

The increase in interest for corporate transparency and disclosure partly results from demand from the financial sector striving to make more informed investment decisions. Company reporting provides information which allows for estimates of investment risk and long-term performance (Amel-Zadeh and Serafeim, 2018; Dyck et al., 2019). This, along with social, governmental and media pressure, as well as genuine concern for sustainable development, has resulted in shareholder pressure promoting open disclosure of information (Amel-Zadeh and Serafeim, 2018; Jansson and Biel, 2014). Transparency has also become a key aspect of Goal 12: 'Responsible Consumption and Production' in the UN's SDGs, with target 12.6 aiming to 'Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle' (UN, 2015). Increasing the transparency and disclosure of the palm oil industry with respect to its environmental, social and governance performance (hereafter ESG disclosure) will be an important part of reaching this goal by 2030, and initiatives like the Accountability Framework offer opportunities for monitoring supply chain commitments. However, currently, there is no clear and consistent way of tracking this progress, so we set out to develop a global, broadly representative, measure for tracking ESG disclosure in the palm oil sector.

Launched in 2014, SPOTT (Sustainability Policy Transparency Toolkit) supports sustainable commodity production and trade (www.spott.org). The initiative assesses publicly and privately listed palm oil and other commodity companies on the public disclosure of their organisation, policies, and practices as they relate to ESG best practice. This supports constructive industry engagement from the users of SPOTT, those which have power to influence companies' practises on the ground, such as investors, ESG analysts, buyers, and other supply chain stakeholders. In doing so, SPOTT aims to incentivise corporate best practice in key ESG areas of a wider pool of companies in each sector, not just those currently certified under the RSPO or other sustainability certification schemes.

Although SPOTT initially focused primarily on assessing companies based on the disclosure of an appropriate ESG policy (e.g., no deforestation or zero burning), SPOTT has evolved to also assess companies' reporting on the implementation of policies (e.g., activities to monitor deforestation or to manage fires). In other words, SPOTT does not only measure the consistency and accessibility of commitments, it also aims to assess the robustness of these commitments (and that company commitments translate into meaningful implementation on the ground). However, SPOTT stops short of assessing implementation of policies and commitments themselves and, as such, a high level of compliance in terms of company disclosure does not necessarily mean that a company is sustainable in terms of impact on the ground.

Selection of a company to be assessed on SPOTT has been based on several criteria, including: market capitalisation and size of revenue derived from palm oil; size of land holdings under palm oil production; the company's media attention; and status of biodiversity and the threat posed by commodity production in the operating country. Companies can also be nominated by users or volunteer themselves for assessment. Successive assessments have seen increased numbers of palm oil producers, processors and traders being added to SPOTT since inception; as of November 2020, SPOTT assesses 100 palm oil companies (producers, processors and traders), collectively representing nearly 60% of the global oil palm landbank (Table A.3), against a comprehensive indicator framework.

The SPOTT indicator framework was developed in consultation with companies, the financial sector and other key stakeholders such as civil society organisations and has been closely aligned with related initiatives including the Accountability Framework initiative. In 2014, the indicator framework comprised 49 indicators, primarily focused on measuring the disclosure of environmental policies; as of 2020, companies are assessed against 180 indicators across 10 discrete categories that cover multiple dimensions of ESG best practice, with the maximum score for each indicator being 1 (SPOTT, 2019). Categories include 'Sustainability policy and leadership' and 'Deforestation and biodiversity', which contain indicators relevant to that category such as, 'Sustainable palm oil policy or commitment for all its operations' and 'Examples of species conservation activities'. To date, there have been more than seven years of assessments conducted using these different frameworks, undertaken for an increasing number of companies. Using five years of data compiled between 2014 and 2018 we set out to develop a proof-of-concept 'SPOTT Index', to track the public disclosure of palm oil company ESG policies over time using SPOTT data.

To inform the development of the SPOTT Index, we drew on an existing well-established metric that, at least conceptually, has some similarities with SPOTT: the IUCN Red List Index (RLI). The RLI was initially developed in 2004 (Butchart et al., 2004) and subsequently refined (Butchart et al., 2007) and serves as an indicator of the aggregate rate at which all species, in a given taxonomic group, are moving towards extinction. This rate is measured by changes in the IUCN Red List Category over time and requires a species to have been assessed at least twice within periods of at least four years (the minimum period over which change is likely to be observed). The RLI has been widely adopted for use as an indicator in the Convention on Biological Diversity (CBD) and for reporting against the SDGs (Brooks et al., 2015).

In the current study, we set out to test different approaches for producing an easily understood index, drawing on the RLI methodology, for tracking the rate at which palm oil companies are moving towards full public ESG disclosure over time (as assessed against the SPOTT indicator framework). We focus especially on: i) testing what impact the addition of new company assessments has over time on the index, and the implications thereof; ii) trialling whether the index can be disaggregated (e.g., by market capitalisation); and iii) estimating uncertainty.

2. Methods

2.1. Transparency assessments for palm oil companies

SPOTT assessments were initially undertaken quarterly and more recently have changed to being completed annually. In the current study, the data used to calculate the indices were derived from five assessments undertaken in: October 2014; October 2015; October 2016; November 2017 and November 2018. The number of companies assessed at each time period increased from 20 (representing ~22% of the current total oil palm landbank) in October 2014 to 68 (~49% of the total landbank) in November 2018 (Table A.1). Two companies were removed from the analysis due to being removed from SPOTT assessments, either due to being assessed under their parent company or were perceived to be low impact.

2.2. The SPOTT indicator framework

To gain points relative to each indicator, a company must make required information publicly available (i.e., on its website, within its annual reports, or in other public documents). As noted above, some indicators also consider the quality of policies and commitments that are disclosed, with higher scores awarded for more comprehensive policies or for externally verified information on implementation (see supplementary materials [file 1]). Consistency between company assessments is ensured through the use of 'scoring criteria' which outline the conditions in which a company has satisfied the requirements of an indicator. Assessments are undertaken independent of companies, but companies are provided with an opportunity to review and feedback on draft assessments (for example, although data are not available for earlier time periods, 42 out of 99 and 52 out of 100 took this opportunity in the 2019 assessment period, respectively).

As the indicator framework underwent several significant changes between 2014 and 2018, we first set out to align the indicators that had been consistently used over this time period. Subsequently, scores from 37 indicators that had been consistently used throughout this time period were used (see supplementary materials [file 2]). These 37 indicators skew slightly more towards those that focus more on the disclosure of environmental policies, given their predominance in earlier indicator frameworks. We did not investigate the impact of changing the indicator framework over time on the Index (but see 4.0), primarily because the intention has always been to stabilise the indicator framework (indeed, since 2019 the indicator set has remained almost unchanged).

SPOTT assessors have the option to temporarily or permanently disable framework indicators that were not relevant at the time or did not apply to a specific company. For example, during the 2015 assessment period indicator 7.1 was not included in assessments of several companies due to ongoing legal issues with publishing concession maps in Indonesia and Malaysia. To uphold indicator consistency, when an indicator had been disabled during the time period of one assessment, we also disabled that indicator for all previous and subsequent assessments.

2.3. Identifying genuine score changes between SPOTT assessments

One critical factor in the production of a Red List Index is that it requires distinguishing changes in Red List Category between assessments that are caused by genuine improvements or deteriorations from those caused by assessor error, changing knowledge or changes in taxonomy. This is facilitated through a process of retrospective assessment that interrogates the integrity of a previous assessment at the time of the new assessment. For example, if new information indicates a species would have qualified for a different category than assigned in an earlier assessment, then the retrospectively adjusted category change needs to be incorporated to calculate the RLI (Butchart et al., 2007; Hoffmann et al., 2011). Similarly, published company scores from each SPOTT assessment cannot be directly used to calculate the Index. For example, changes to the way companies are assessed due to updates of the indicator framework and scoring criteria may have resulted in fluctuations in a company's transparency score, but these revisions are not indicative of changes in the public disclosure of a company. Therefore, to identify company score changes occurring between assessments associated with genuine changes in corporate disclosure, each score change was assigned a code indicating a (G) Genuine or (N) Non-genuine score change.

A score change is considered genuine or non-genuine depending on several factors. Score changes are considered 'Genuine' if a company demonstrates a genuine improvement or deterioration, according to any of the following reasons: i) New information was publicly disclosed by the company; ii) Clarifications made by the company through the engagement and feedback process since the previous assessment; and/or iii) Information that was publicly available is no longer accessible during the assessment period. Non-genuine score changes were those resulting from: i) missed information; ii) Reassessment of information originally provided by the company; iii) Revisions of the indicator framework since the previous assessment; and/or iv) Assessor error.

For this study, since we held the indicator framework constant through time, revisions to the indicator framework were irrelevant. Of the remaining reasons, assessor error (iv) was the only non-genuine change that was distinguished retrospectively, due to the difficulty of retrospectively identifying other forms (for example, determining whether disclosed information was inadvertently missed in 2014 that compromised scoring against a particular indicator). The assessor error code (R) was applied where the explanation for a score was the same as a previous or subsequent assessment, but a different score had been awarded. In such instances, it was assumed that the score from the most recent assessment was correct, and was retrospectively assigned (or back-cast) over all indices where the same explanation had been given. All other score changes that were not given the assessor error code were assumed to have undergone genuine improvement or deterioration in score in the period since the previous assessment.

2.4. Calculating SPOTT index values

As the number of companies assessed on SPOTT has changed over time, we wanted to investigate how the SPOTT Index would perform when accounting for an increase and change in the number of companies assessed over time. Index values were calculated based on two complementary approaches: the 'Summative approach' and the 'Mean change approach'. In the Summative approach, we calculated the Index based on two methods: 1a.) Where only companies that have assessments from all five time periods were included (C = 20 companies); and 1b.) Where companies that did not have assessments from all five time periods were included from the time period they began to be assessed (C = 68 companies in 2018). In the 'Mean change approach', the index is calculated where any company that had been assessed two or more times was included from the time period at which it was first assessed (C = 49 Companies in 2018).

2.4.1. Summative approach

The number of companies in each SPOTT assessment and the scores awarded to companies for each of the indicators was used to calculate the indices in the following way:

$$S_{max} = \sum_{I} Ap_i \quad (1)$$

$$S_{c,t} = \sum_{I} Apc_{t,i} \quad (2)$$

$$\mathrm{SPOTT_t} = \sum_{C} \mathrm{S_{c,t}} / (\mathrm{S_{max}} \bullet \mathrm{C}) \quad (3)$$

where S_{max} is the sum of the maximum points available for each indicator, Ap_i (eq. 1). The score awarded to each company c for each indicator I in a given year ($Apc_{t,i}$) was summed to give the total company score $S_{c,t}$ (eq. 2). Then the Index value in a year $SPOTT_t$, equalled the sum of $S_{c,t}$ divided by the value of S_{max} multiplied by C, the number of companies assessed in time period (see Table A.2 for values for C and t for each Index).

In simple terms, the SPOTT Index is calculated as the sum of individual scores assigned to each company in the given time period, divided by the product of the number of companies assessed in the time period and the maximum score achievable for a company. This is equivalent to the mean SPOTT score of all companies assessed in the time period considered, normalised by the maximum value (where 1 = 100%).

2.4.2. Mean change approach

For calculation of these Index values, steps were 1–2, as shown above, however the value of C did not remain constant throughout all time periods (Table A.1).

The SPOTT Index values of companies that had been assessed for more than two years was used to determine the mean change approach Index values. Conceptually, the method borrows from what used to calculate the Living Planet Index (Collen et al., 2009). Steps were 1–2, as previously, followed by:

$$SD_{c,t} = S_{c,t+1} - S_{c,t} \quad (4)$$

$$MD_t = \frac{1}{C} \sum_{C} SD_{c,t} \quad (5)$$

$$MC_{(t+1)} = MC_t + MD_t \quad MC_{2014} = 1 \quad (6)$$

The difference score for a given company between two years, $SD_{c,t}$ is the difference between its scores in a given and following year (eq. 4). The mean score difference, MD_t in a given year is the average of those difference scores across all companies in that year (eq. 5). The value for the Index MC_t at 2014 was set at 1, and subsequent values for MC_{2015}, MC_{2016} etc. were calculated by summing the mean change value of the subsequent year, MD with the index in the previous year (eq. 6).

2.5. Disaggregating indices

One of the purposes of the SPOTT Index is to show trends over time in ESG disclosure according to particular features such as market capitalisation (MCap), landbank holdings, or even their engagement with the SPOTT team. This would allow us to test company performance based on certain characteristics. For example, are companies with larger oil palm landbank holdings better or worse at disclosing information than those with smaller holdings, or do companies that disclose details of their holdings in general perform worse than those that do not? Here, we set out to demonstrate this utility by breaking down the Index by market capitalisation, hypothesising that larger MCap companies would perform better over time than smaller ones. SPOTT companies, where MCap information was provided, were assigned to one of three categories based on finance industry wide definitions: Small ($2 billion USD or below, C = 25); Mid ($2 billion to $10 billion USD, C = 10); and Large ($10 billion USD and above, C = 2) (Chen, 2018). Due to the small sample size of Large MCap companies, for calculating $SPOTT_t$ we combined Mid and Large MCap companies into a single Large MCap category. For this analysis, we wanted to compare the differences in score and changes over time of these two categories, so the summative approach was used.

2.6. Calculating index variance

To provide a measure of uncertainty in Index values, confidence intervals were obtained by using a bootstrap method (as described by Loh et al., (Loh et al., 2005)). For each time period t a sample of ct company-specific values of $SPOTT_t$ were selected at random from the ct observed values with replacement. This process was carried out 1000 times with the upper and lower values of the central 950 Index values taken to represent the 95% confidence interval for that year.

3. Results

3.1. Summative approach

Using the scores awarded to the 20 palm oil companies assessed on SPOTT since its inception, Index values demonstrated a general improvement in disclosure from 2014 to 2018 with values increasing from 0.39 to 0.61, a 22% increase (Fig. 1). Improvement rates were relatively slow between 2014 and 2016, followed by a greater increase occurring between the 2016 and 2017 assessment periods of 11%. Rate of improvement began to slow between 2017 and 2018 with a small increase of 2% (for all values see: Table A.2).

To assess the impact of adding new companies over time on the SPOTT Index, we also calculated SPOTT values by including the scores of companies that had begun to be assessed at successive time periods. The observed trend in the Index demonstrated an apparent improvement from 2014 to 2018, with Index values increasing from 0.39 to 0.49 (10%). In particular, the addition of 25 and 19 companies at time periods 2015 and 2018, resulted in a deteriorations of 1% and 5%, respectively, on the previous year's value (Fig. 2). When disaggregating the collective Index values of companies that were added to SPOTT in successive years, results indicate that those that were added in 2017 (when only four companies were added) started with the highest Index value of 0.6, whereas those added in 2015 and 2018 showed the lowest with 0.32 and 0.33, respectively. Companies added in 2014 showed the largest improvement of all companies with an increase of 11% between the 2016

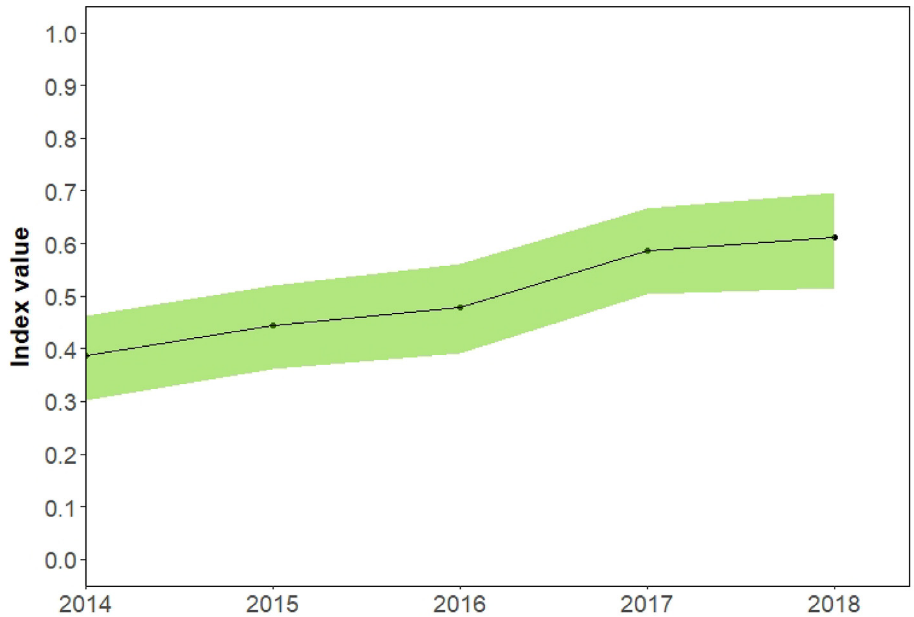

Fig. 1. The Index values of companies consistently assessed on SPOTT in each time period, with 95% confidence intervals. An Index value of 1 equates to all companies scoring a maximum achievable score against all indicators; a value of 0 equates to all companies scoring 0 against all indicators. Improvements in ESG disclosure lead to increases in the Index; deteriorations lead to declines. Sample size: C = 20 companies.

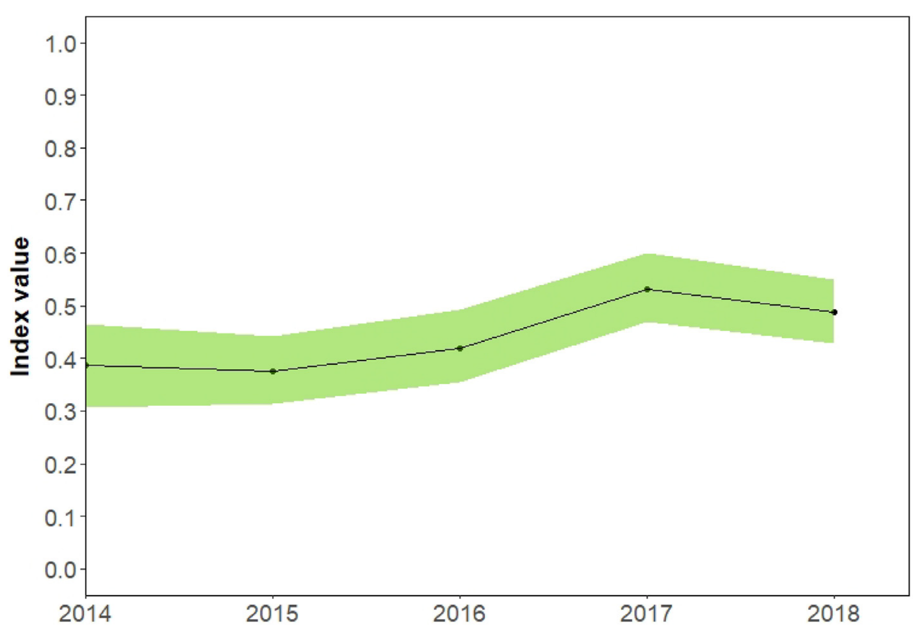

Fig. 2. The Index values of companies assessed on SPOTT, where the number of companies assessed increased in 2015, 2017 and 2018, with 95% confidence intervals. An Index value of 1 equates to all companies scoring a maximum achievable score against all indicators; a value of 0 equates to all companies scoring 0 against all indicators. Improvements in ESG disclosure lead to increases in the Index; deteriorations lead to declines. Sample size: 2014, C = 20; 2015, C = 45; 2016, C = 45; 2017, C = 49; 2018, C = 68.

and 2017 assessments. There was no set of companies that had been assessed more than once that showed a deterioration in Index value between assessments (Fig. A.1).

3.2. Mean change approach

The mean score change, with increasing numbers of companies, between assessment years, shows an overall increase of 22% between 2014 and 2018 (Fig. 3). The greatest rate of improvement occurs between 2016 and 2018 with a 13% increase, in comparison with a 9% increase in Index value between 2014 and 2016.

3.3. Disaggregation of the index with increasing numbers of companies

We assessed the utility of the SPOTT Index by breaking it down by market capitalisation (Fig. 4). This disaggregation shows those companies in

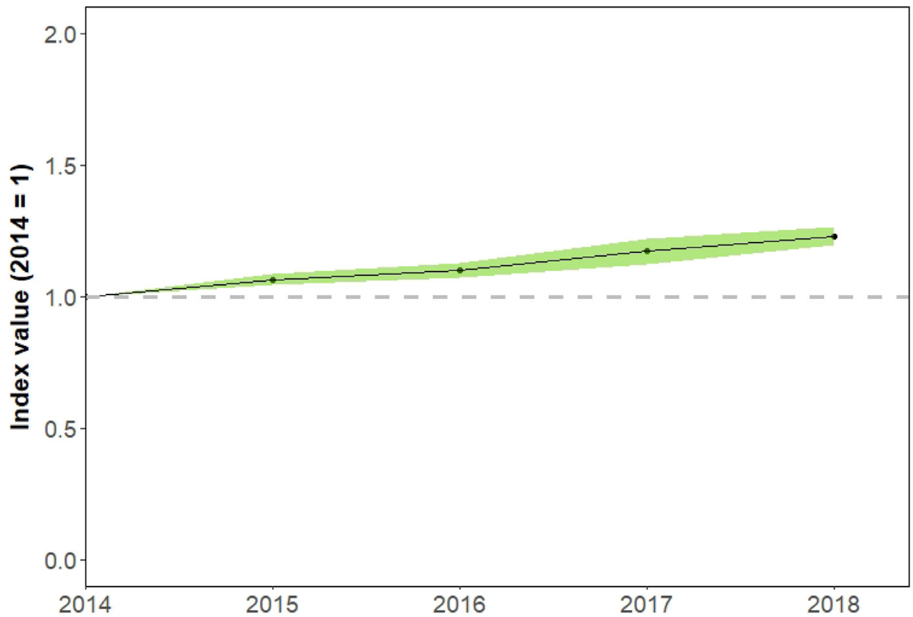

Fig. 3. The mean score change of companies assessed on SPOTT, where the number of companies assessed increased in 2015 and 2017, with 95% confidence intervals. The Index starts at a value of 1. If the Index and confidence limits move above 1, there has been an increase in public disclosure; if they drop below 1, then there has been a decline in comparison with 2014. Sample size: 2014, C = 20; 2015, C = 45; 2016, C = 45; 2017, C = 49; 2018, C = 49.

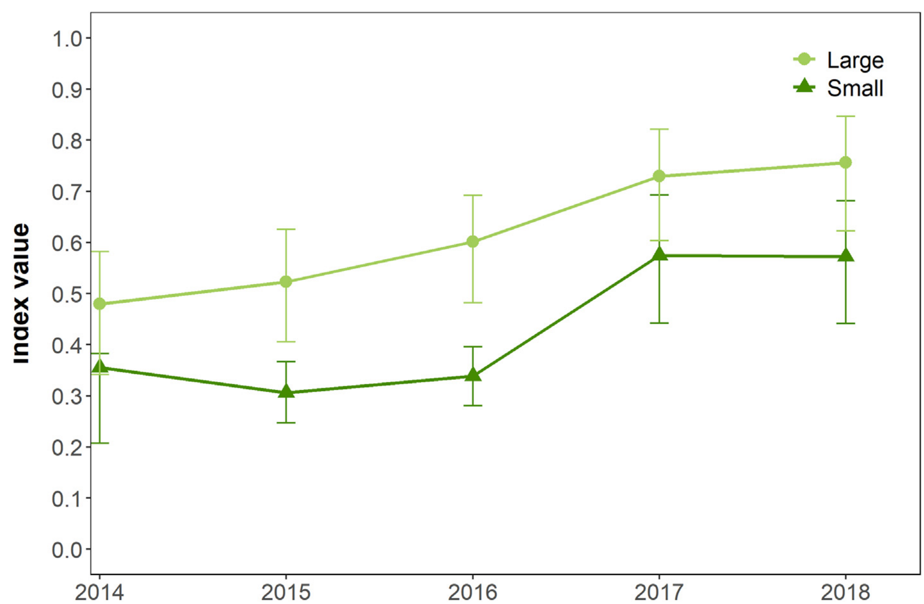

Fig. 4. The Index values of companies assessed on SPOTT disaggregated by small and large market capitalisation with 95% confidence intervals. An Index value of 1 equates to all companies scoring a maximum achievable score against all indicators; a value of 0 equates to all companies scoring 0 against all indicators. Improvements in ESG disclosure lead to increases in the Index; deteriorations lead to declines. 'Small' represents companies with MCap below $2 Billion USD, 'Large' represents companies with MCap above $2 Billion USD. Sample sizes: 2014, C = 10/6 (Small/Large, respectively); 2015, C = 24/8; 2016, C = 24/8; 2017, C = 24/9; 2018, C = 25/10.

the 'Small' category have had consistently lower public disclosure than those in the 'Large' category, although they have both demonstrated improvement in their policy disclosure at a more-or-less similar rate. For Small companies, Index values increased from 0.36 to 0.57 (a change of 21%) compared with an increase from 0.48 to 0.76 (28%) for Large companies. The largest increase in policy disclosure occurred for both categories between the 2016 and 2017 assessments, followed by a slight decline in 2018 for Small companies.

4. Discussion

4.1. Are palm oil companies improving their ESG disclosure?

We developed and tested a proof-of-concept Index with the potential to provide a comprehensive metric of whether ESG disclosure in the palm oil industry is improving or deteriorating over time and the rate at which it is doing so, based on repeated SPOTT assessments. The Index shows that the overall disclosure of companies assessed between 2014 and 2018 using the SPOTT indicator framework improved steadily over the five-year period, a pattern that holds true whether holding the number of companies included constant throughout all time periods (Fig. 1) or including additional companies at each subsequent time period of assessment (Fig. 2). In particular, when holding companies constant subsequent to their first assessment in 2014, Index values showed a noticeable increase in ESG disclosure between 2016 and 2017 (11%). This peak may have occurred due to a number of events in the industry, including the 2015 Southeast Asian haze and the suspension of IOI Corporation's RSPO certification in 2016 (Henisz and McGlinch, 2019), leading to many major buyer companies requiring RSPO certification of producers. As a result, this event may have sparked an increase of reporting in the industry, especially given the negative consequences experienced by IOI Corporation, including being dropped by several major multinationals including Kellogg's and Mars (Ceres and Climate Advisors, 2017; Lambin et al., 2018). Other possible factors include efforts from civil society organisations, increased consumer pressure and the call for more informed investments, and activities of groups such as the Principles for Responsible Investment (PRI) Working Group, which has worked to raise awareness among investors of the ESG issues that arise in the palm oil value chain, and increased awareness and traction of SPOTT itself. Nevertheless, it is worth noting that whilst many companies experienced an increase in Index value between 2014 and 2018, some (C = 3) showed only marginal improvement, and some (C = 7) showed declines during this period (Fig. A.2).

We also tested how the Index performed when we added new companies at different time periods. Although there is an overall increase in the Index values between 2014 and 2018, the addition of new companies in 2015 resulted in a reduction in the Index value in 2015 in comparison with when companies are held constant. This effect can also be observed in 2018 when new companies were added (Fig. 2). This decline in Index value is likely a result of adding a set of companies that have an overall lower starting Index value than those already included at a previous assessment period (Fig. A.1). However, although adding companies had a negative impact on the overall Index value, the mean change index demonstrated an overall increase regardless of the negative impact of the addition of companies (Fig. 3). As companies added in 2018 had not yet been assessed twice, they could not be included in the mean change approach; consequently, we were unable to observe if the mean change Index values continued to improve, even while the summative approach showed a decline (Fig. 2).

The addition of companies to SPOTT assessments has occurred in a systematic way. Large public companies were the first to be assessed in 2014, as they were considered to have the largest environmental impact and potential for improvement under SPOTT assessment (SPOTT. New Companies Selected for Assessment in, 2018) (by today's estimation, these 20 companies represent approximately one-fifth of total global oil palm landbank). Subsequently, companies added after the first assessments in 2014 tended to include smaller, more privately owned companies which serve markets where demand for sustainable palm oil is lower and do not receive the same amount of pressure to improve practices from the financial sector investors with strong ESG investment criteria, as reflected in the lower number of articles about these companies in the SPOTT media monitor (SPOTT. New Companies Selected for Assessment in, 2018). This may partly explain why companies added in 2015 and 2018 have lower scores, whereas it may not be possible to draw a conclusion of those added in 2017 due to the small sample size (C = 4). In recent years, the number of companies assessed on SPOTT has stabilised at 100 companies.

The SPOTT Index can be calculated for specific features of companies that may have specific conservation or policy importance, such as land holdings and market capitalisation. For example, there is a particular interest in seeing progress in public disclosure of smaller MCap companies to ensure that improvements are being made throughout the industry, and not just by larger companies that have greater access to resources and pressure to improve (Packard Foundation, 2019). The SPOTT Index for market capitalisation provides some evidence that companies in the Small MCap category ($2 billion USD and below) consistently performed worse on ESG disclosure. As smaller MCap companies tend to be privately owned the pressure they receive to improve in terms of ESG reporting may be less, as well as more limited resources for improving their disclosure and practises. Nevertheless, ‘Small' companies have shown improvements at similar rates to ‘Large’ companies. This may be a result of the increased pressure the industry over the timeframe of assessments. However, the variation observed in this result is most likely due to the large differences between company operations of growers, processors and traders, regardless of market capitalisation (Table A.2) (Basiron, 2007).

4.2. Score change calculation

The calculation of the SPOTT Index is based on the summation of company scores, which are calculated to be proportional to the number of companies included at a specific time period, normalised by the maximum score achievable. This produces an index which is sensitive to all changes in companies' scores, with all score improvements and deteriorations resulting in noticeable changes in the Index value. The advantage of this approach is that it is simple, and the trend is driven by all companies present in the assessment period. Hence, the resulting index is representative of the state of corporate disclosure at that point in time.

In the early years of SPOTT's development, the addition of new companies over time was key to ensuring that SPOTT became broadly more representative of the sector, resulting in a significant year-on-year change in the number of companies assessed between 2014 and 2018. However, as noted above, the addition of many new companies at specific time periods resulted in a deterioration of the Index value or a reduction in the rate of improvement, likely driven by the overall poorer public disclosure of these newly added companies. Consequently, the summative approach, using method 1b, is likely not viable. One option to resolve the issue of the availability of assessments for newly included companies in earlier time periods would be to back-cast the assessments (such that these companies could be included in the Index using the summative approach 1a). This would be a methodological approach similar to that taken for calculating the Red List Index when, for example, new species are described (Butchart et al., 2004; Butchart et al., 2007). However, this would be hugely resource intensive and impractical to implement on SPOTT: for example, doing this for even a single new company added in 2021, would require the company to be assessed against 180 different indicators in seven previous assessment years (this would not, of course, be necessary if the company were newly established). It would also be very difficult, and in many cases impossible, to determine and verify the actual company score at much earlier time periods for each indicator. In that case, the default would have to be to assume no change between assessment periods (unless evidence presented to the contrary). This approach of assuming no change is also standard with the Red List Index, as it avoids overestimating deterioration in extinction risk; however, there is a risk that in the SPOTT Index such an approach could inadvertently underestimate improvements that companies have made on their public disclosure. Nonetheless, there may still be merit in this for instances in which a few companies are added.

We also tested a complementary ‘mean change’ approach, where the difference in mean score between years was calculated. Whereas the summative approach gives an Index that is influenced by the addition of new companies, the mean change approach is heavily influenced only when there was a collective change in company score between years in one direction or the other. For example, if one company score shows a large increase, but other companies' scores remain constant since the previous assessment, the Index value will register no noticeable change (whereas the SPOTT Index based on the summative approach would show an increase). Thus, the mean change approach represents the collective difference in company Index values through time, whereas the summative approach gives a snapshot of the state of public disclosure in those companies assessed as a whole.

While we observed fluctuations in the Index using the summative method when the number of companies was increased between 2014 and 2018, the number of companies assessed on SPOTT has also plateaued and is now being held relatively stable at 100 companies. As such, while new companies are likely to be added in future, we see most value in the summative approach going forwards given it is simple and intuitive, especially with long-term repeated assessments of all companies over time. However, when comparing overall scores from years with differing numbers of companies, the mean change approach has merit, although only companies that have two or more years of data can be included.

4.3. Strengths of the SPOTT index

The greatest strength of the SPOTT Index is that index values are calculated using data collected against a comprehensive indicator framework, and which has been formulated through in-depth consultation with companies and users of SPOTT. Although this indicator framework has been subject to a degree of dynamism over the years, it has now stabilised with a robust suite of 180 indicators covering a diverse set of ESG categories. This should allow for the production of an Index based on broad but detailed information on ESG policies of those companies assessed.

With the ability to identify trends via disaggregation of variables such as market capitalisation, landbank and even company engagement on SPOTT, policy and on-the-ground work within the industry can become more targeted and effective. Furthermore, the progress tracking of companies and subsequent pressure to improve is enhanced by the ability to also produce an individual SPOTT Index for each company. These features are enhanced by the Index being designed to be easy to understand, especially with the summative approach, and such that it can be related to by the finance sector: in the summative approach, a score of 1 would indicate that all companies assessed have achieved full marks (i.e., 100%) in terms of ESG public disclosure (as assessed on SPOTT), and a score of 0 being the opposite; in the mean change approach, an Index value above 1 means ESG disclosure is improving, while if it drops below 1, then there has been a deterioration.

4.4. Weaknesses of the SPOTT index

There are some current limitations of the SPOTT Index for measuring progress of ESG disclosure. First, the more comprehensive suite of ESG indicators only started to be implemented in 2019, meaning that the SPOTT Index can only provide a broader metric of ESG disclosure over time since that date; however, the majority of the environmental indicators predate that time, so the Index does provide a good measure of change in public disclosure of environmental policies and commitments. Second, our proof-of-concept approach is tested on palm oil companies only. However, SPOTT has already accumulated several years of data assessing timber and pulp companies (now totaling 100 companies) and has also recently expanded into assessing natural rubber companies. Hence, as with the Red List Index, where it is possible to aggregate indices for multiple taxa into a single aggregated index, it should be possible to aggregate indices for palm oil, timber and pulp, and natural rubber companies, and indeed for other sectors as they come online, to produce a single aggregated SPOTT Index of public disclosure across several plantation-based commodity companies over time.

Methodologically, an important caveat with our index concerns data limitations from early assessment years. In the data years we included in our study, SPOTT assessors did not systematically record if score improvements or deteriorations were a result of genuine or non-genuine changes. The current study was only able to identify and address one type of non-genuine change: assessor error on the grounds that the explanation provided for awarding a score was not consistent with the score awarded for the same explanation in a different assessment period. In these instances, it was assumed that the score from the newest assessment was correct, and so was retrospectively assigned to the earlier time-periods. However, this assumption could have resulted in genuine score changes being erased. Additionally, the detail given in some explanations for scores were not sufficient to decipher if changes in scores between assessment periods were genuine changes or not, and as a result the methodology here assumes that these were genuine (when in fact they may have been non-genuine). Hence a key criterion to ensure the utility of the SPOTT Index in the future is that assessors are clearly distinguishing genuine from non-genuine changes in indicator score, including information on the reasons for such change wherever possible, a measure which is now being enacted as part of the SPOTT assessment scoring criteria.

4.5. Future directions

We anticipate that just as the Red List Index was revised several years after it was first promulgated (Butchart et al., 2004), we may need to apply changes to the SPOTT Index formulation, especially as the merits of the summative versus mean change approaches are tested further with new SPOTT assessment data.

This study only looked at the impact that adding companies had on the Index. Since SPOTT was conceived, the indicator framework has undergone multiple revisions and iterations, expanding from a more limited set of indicators that were more “Environmental” in scope to a comprehensive, suite of 180 indicators that cut across the ESG space. However, while it is likely that the indicator framework used for SPOTT assessments will continue to undergo refinement over time, the indicator framework has also reached a point of maturity. This constancy is key to ensuring that, going forwards, the SPOTT Index is based on the more comprehensive suite of indicators that extend beyond just organisational and policy disclosure and include best practice on the ground. In general, we strongly recommend minimising changes to the indicator framework as far as possible. Nonetheless, an alternative configuration of the SPOTT Index would be to calculate the Index as the sum of individual scores assigned to each indicator in the given time period, divided by the product of the number of companies assessed in the time period and the maximum score achievable for that indicator (Eq. A.1). This could be an avenue for further investigation.

One additional area where we see potential is for the Index to be disaggregated by indicator category. For example, the current indicator framework (i.e., comprising 180 indicators) has two categories of indicators, “Community, land and labour rights” and “Governance and grievances”, which could in principle be used to help measure progress by sector relative to the Sustainable Development Goals (e.g., against SDG 8.5). We could not test this in our initial scoping as we could only make use of those indicators (skewed more towards the environmental, than the social and governance issues) that had been applied consistently between 2014 and 2018. However, with the indicator framework now being held relatively constant, this should be eminently feasible in future. Furthermore, investigation into which indicator suites are driving the greatest change to Index values, could provide important insights into where the industry is focusing the most attention and vice versa.

Finally, how to interpret our initial results relative to the SDG target 12.6? Currently, the only available indicator for evaluating progress against this target aims to track the number of companies publishing sustainability reports, but although there is an available work plan for the development of the 12.6 target indicator (see https://unstats.un.org/sdgs/tierIII-indicators/files/Tier3-12-06-01.pdf) there have been no recent developments. We suggest that the SPOTT Index could present a new and complementary metric for monitoring progress towards this (and potentially other) targets, including through disaggregation of the Index by indicator category, albeit this is currently constrained and only tracks disclosure in a few commodity sectors (palm oil, timber and pulp, and natural rubber). However, sustained support of SPOTT, and continued growth into other sectors, should allow for the production of a powerful metric in tracking ESG disclosure that could help further incentivise sustainable production and consumption in the commodities sector.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

SPOTT assessment data analysed in this paper were produced with financial support from The David and Lucile Packard Foundation (2019-68302), UK Foreign, Commonwealth and Development Office (FGMC2018-22-ZSL), Credit Suisse.

Appendix A. Appendix

Table A.1
The assessment time periods used in this study, the number of palm oil companies that were included in the analysis at that time period, and the indicator framework used during that assessment.

Assessment period (*t*)	*C*	Indicator framework
October 2014	20	October 2014
October 2015	45	(Available on request: www.spott.org)
October 2016	45	
November 2017	49	November 2017 (Available on request: www.spott.org)
November 2018	68	November 2018 (Available on request: www.spott.org)

Table A.2
The Index values, upper and lower confidence intervals (CI), and number of companies at each assessment period of Figs. 1-4. Subscript indicates which plot value is being referred to, i.e., '$_S$' and '$_L$' indicate values associated with Small and Large MCap, respectively.

Figure		Assessment period (*t*)				
		2014	2015	2016	2017	2018
Fig. 1.	*C*	20	20	20	20	20
	Index value	0.3870020	0.4433808	0.4784840	0.5866689	0.6111705
	Upper CI	0.468033	0.5245439	0.5635978	0.6677936	0.7037399
	Lower CI	0.3077704	0.3623326	0.3959687	0.5023575	0.5173758
Fig. 2.	*C*	20	45	45	49	68
	Index value	0.3870020	0.3754571	0.4187724	0.5319938	0.4883585
	Upper CI	0.4698889	0.4362018	0.4837802	0.5933710	0.5493309
	Lower CI	0.3070722	0.3128464	0.3545104	0.4692634	0.4262340
Fig. 3.	*C*	NA	20	45	45	49
	Index Value	1.00	1.063891	1.098797	1.171105	1.228938
	Upper CI	1.00	1.084982	1.125014	1.213187	1.261648
	Lower CI	1.00	1.044464	1.072524	1.120691	1.193860
Fig. 4	*C*	10_S	24_S	24_S	24_S	25_S
		6_L	8_L	8_L	9_L	10_L
	Index Value	0.3552618_S	0.3061378_S	0.3388561_S	0.5749431_S	0.5723805_S
		0.4792218_L	0.5231405_L	0.6017258_L	0.7294068_L	0.7561448_L
	Upper CI	0.3786501_S	0.3637987_S	0.3918759_S	0.6936980_S	0.6799670_S
		0.5786359_L	0.6217334_L	0.6953977_L	0.8248963_L	0.8486959_L
	Lower CI	0.2134815_S	0.2494458_S	0.2860790_S	0.4448731_S	0.4474477_S
		0.3426109_L	0.4068224_L	0.4755495_L	0.5946118_L	0.6181194_L

Table A.3
Estimated proportion of total landbank represented by SPOTT-assessed companies. Global landbank estimate based on (Meijaard et al., 2018). These figures were reconstructed for illustrative purposes only, based on various sources of publicly available information including the listed companies' own websites or NGO reports. Figures may be inadequately described or inaccurate at the time they are published, and may have become outdated between their first publication and the time they were collected. Where no information is found to contradict past figures, such as announcements related to the acquisition or sale of land concessions, the most recent figure is assumed to stand.

Company	2020 - Landbank (kHa) - Total land area managed/controlled for oil palm (ha)
3F Industries	0.0
AAK AB	0.0
Agritrade International Pte Ltd	0.0
AgroAmerica	26.0
Agropalma Group	117.9
Allana Group	0.0
Anglo-Eastern Plantations plc	128.2
Apical Group	0.0
Archer Daniels Midland Company (ADM)	0.0
Asian Agri Group	161.9
Astra Agro Lestari Tbk PT	291.0
Atama Plantation Sarl	470.0
Austindo Nusantara Jaya Tbk PT	157.7

(continued on next page)

Table A.3 (*continued*)

Company	2020 - Landbank (kHa) - Total land area managed/controlled for oil palm (ha)
Bakrie Sumatera Plantations Tbk PT	61.4
Belém Bioenergia Brasil (BBB)	0.0
Best Group	0.0
Bewani Oil Palm Plantations Limited	100.0
Biopalma da Amazônia S.A.	156.5
BLD Plantation Bhd (Bintulu Lumber Development (BLD) Plantation)	51.4
Boustead Plantations Bhd	98.2
Bumitama Agri Ltd	234.0
Bunge Ltd	0.0
C.I. Biocosta S.A.	0.0
Cargill Inc	147.0
Carotino Group	40.6
Daabon	12.3
Danec S.A.	30.2
Darmex Agro Group PT	200.0
Dharma Satya Nusantara Tbk	155.6
Eagle High Plantations Tbk PT	220.0
Emami Agrotech Ltd	0.0
ENI SpA	0.0
FELCRA Bhd	250.1
Feronia Inc	103.6
FGV Holdings Bhd	432.7
Boustead Plantations Bhd	98.2
Bumitama Agri Ltd	234.0
Bunge Ltd	0.0
C.I. Biocosta S.A.	0.0
Cargill Inc	147.0
Carotino Group	40.6
Daabon	12.3
Danec S.A.	30.2
Darmex Agro Group PT	200.0
Dharma Satya Nusantara Tbk	155.6
Eagle High Plantations Tbk PT	220.0
Emami Agrotech Ltd	0.0
ENI SpA	0.0
FELCRA Bhd	250.1
Feronia Inc	103.6
FGV Holdings Bhd	432.7
First Resources Ltd	232.0
GAMA Plantation now KPN Plantations	199.7
Genting Plantations Bhd	242.5
Glencore Agriculture B.V.	0.0
Glenealy Plantations Sdn Bhd	51.3
Gokul Agro Resources Ltd	0.0
Golden Agri Resources Ltd	568.7
Golden Plantation Tbk PT	63.4
Golden Veroleum (Liberia) Inc (GVL)	40.6
Goodhope Asia Holdings Ltd	130.2
Gozco Plantations Tbk PT	23.7
Groupe Blattner Elwyn	24.4
Grupo Jaremar	14.9
Hap Seng Plantation Holdings Bhd	40.2
Hayel Saeed Anam Group	0.0
IFFCO (FGV)	0.0
IJM Plantations Bhd	73.3
Indofood Agri Resources Ltd	356.6
IOI Corporation Bhd	211.4
Itochu Corporation	0.0
Jaya Tiasa Holdings Bhd	83.5
K Global Ventures Sdn Bhd	no longer assessed
Kencana Agri Ltd	186.7
Kharisma Pemasaran Bersama Nusantara PT (PT. KPBN)	0.0
Korindo Group	121.0
KS Oils Ltd	0.0
Kuala Lumpur Kepong Bhd	300.7
Kulim (Malaysia) Bhd	65.4
LLC KRC EFKO-Kaskad	0.0
Louis Dreyfus Company	0.0
M.P. Evans Group plc	70.5
Makin Group	140.0
Mewah Group	2.8
Musim Mas Group PT	199.2
NaturAceites S.A.	12.9
New Britain Palm Oil Ltd	146.1
Nishin OilliO	0.0
Olam International Ltd	202.7

Table A.3 (*continued*)

Company	2020 - Landbank (kHa) - Total land area managed/controlled for oil palm (ha)
Palmaceite S.A.	15.0
Palmas Group	33.7
Patum Vegetable Oil Company Ltd	0.0
Peak Palm Oil plc	100.0
Permata Hijau Group	16.2
POSCO International	34.2
Priya Gold Oils	0.0
PTT Green Energy Pte Ltd	No longer assessed
QL Resources Bhd	16.2
R.E.A. Holdings plc	89.1
Reforestadadora de Palmas de el Peten S.A. (REPSA)	27.4
Royal Industries Indonesia PT	100.0
Ruchi Soya Industries Ltd	200.0
Sampoerna Agro Tbk PT	241.8
Sarawak Oil Palms Bhd	122.0
Sawit Sumbermas Sarana Tbk PT	93.7
Sazean Holdings	0.0
SIFCA Group	194.0
Sime Darby Plantation Sdn Bhd	727.4
SIPEF	136.1
Siva Group	no longer assessed
Socfin Group S.A.	115.8
Synergy Oil Nusantara PT (PT SON)	no longer assessed
Tianjin Julong Group	140.0
Tradewinds Plantation Bhd	141.4
Triputra Agro Persada Group PT	74.9
TSH Resources Bhd	103.9
Tunas Baru Lampung Tbk PT	78.2
United Plantations Bhd	58.9
Wilmar International Ltd	353.7
Total	10,664.0

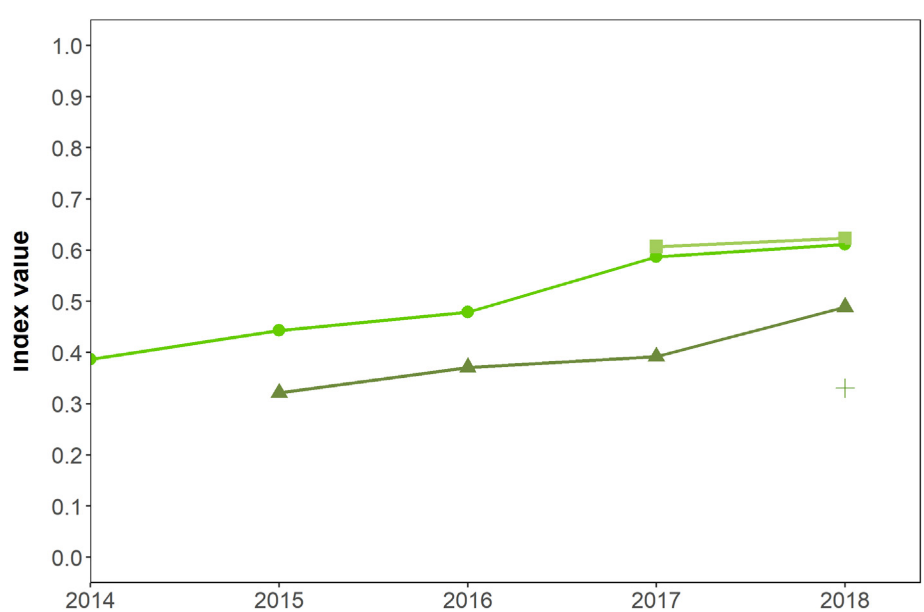

Fig. A.1. The Index values of companies assessed on SPOTT, disaggregated by the date they were first assessed. The first point in each trend aligns with the assessment period those companies were added to SPOTT. An Index value of 1 equates to all companies scoring a maximum achievable score against all indicators; a value of 0 equates to all companies scoring 0 against all indicators. Improvements in ESG disclosure lead to increases in the Index; deteriorations lead to declines. Sample sizes (companies added in): 2014, C = 20; 2015, C = 15; 2017, C = 4; 2018, C = 19. Confidence intervals not shown.

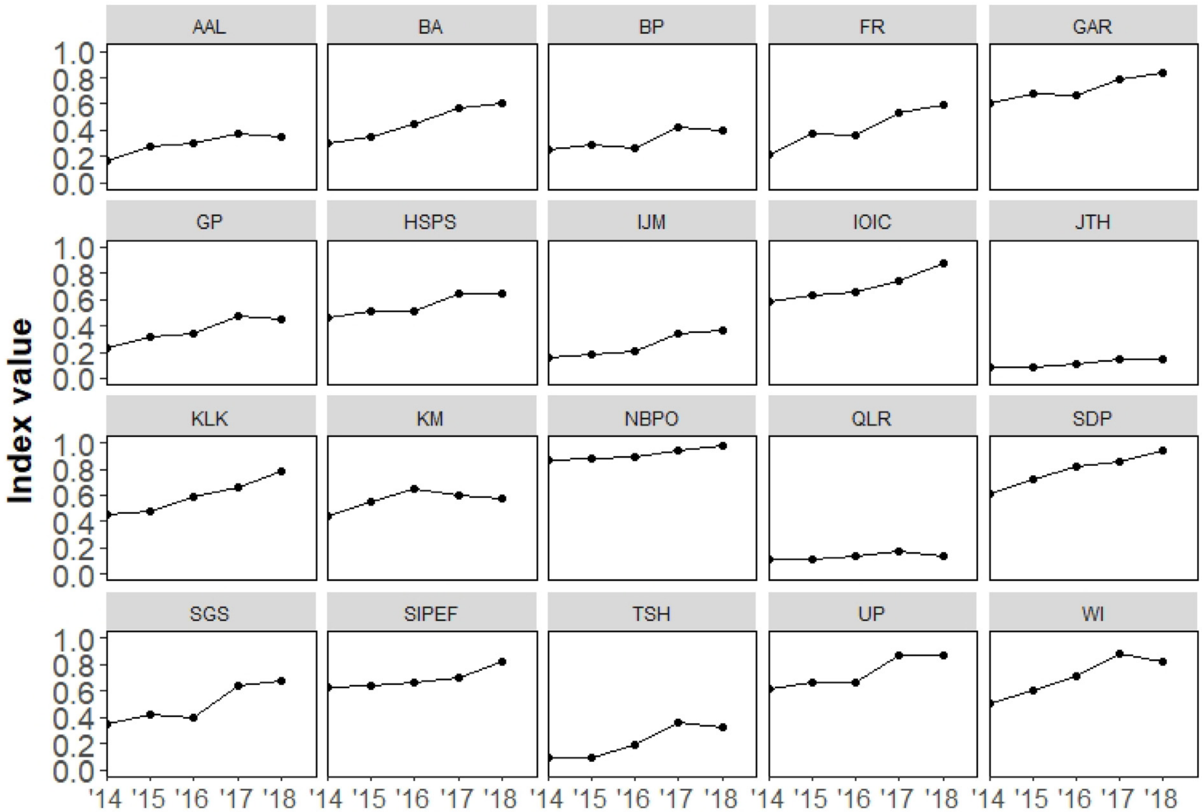

Fig. A.2. The disaggregated Index values of the set of 20 companies that have been assessed since the start of SPOTT in October 2014. An Index value of 1 equates to all companies scoring a maximum achievable score against all indicators; a value of 0 equates to all companies scoring 0 against all indicators. Improvements in ESG disclosure lead to increases in the Index; deteriorations lead to declines. Sample size C = 20. **AAL**: Astra Agro Lestari Tbk PT; **BA**: Bumitama Agri Ltd.; **BP**: Boustead Plantations Bhd; **FR**: First Resources Ltd.; **GAR**: Golden Agri Resources Ltd.; **GP**: Genting Plantations Bhd; **HSPS**: Hap Seng Plantation Holdings Bhd; **IJM**: IJM Plantations Bhd; **IOIC**: IOI Corporation Bhd; **JTH**: Jaya Tiasa Holdings Bhd; **KLK**: Kuala Lumpur Kepong Bhd; **KM**: Kulim (Malaysia) Bhd; **NBPO**: New Britain Palm Oil Ltd.; **QLR**: New Britain Palm Oil Ltd.; **SDP**: Sime Darby Plantation Sdn Bhd; **SGS**: Socfin Group SA; **SIPEF**: SIPEF; **TSH**: TSH Resources Bhd; **UP**: United Plantations; **WI**: Wilmar International.

Eq. (A.1) Alternative index formula

An alternative configuration of the SPOTT Index would be to calculate the Index as the sum of individual scores assigned to each indicator in the given time period, divided by the product of the number of companies assessed in the time period and the maximum score achievable for that indicator, as follows:

$$S_{max} = \sum_{I} Ap_i \tag{1}$$

$$S_{I,t} = \sum_{I} Ap_{i,t} \tag{2}$$

$$\mathrm{SPOTT_t} = \sum \mathrm{S_{I,t}} / (\mathrm{S_{max}} \bullet \mathrm{C}) \tag{3}$$

where S_{max} is the sum of the maximum points available for each indicator, Ap_i (eq. 1). The score awarded to each indicator i in a given year ($Ap_{i,t}$) was summed to give the total indicator score $S_{I,t}$ (eq. 2). Then the Index value in a year $SPOTT_t$, equalled the sum of $S_{I,t}$ divided by the value of S_{max} multiplied by C, the number of companies assessed in time period (see Table S2 for values for C and t for each Index).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.crsust.2021.100042.

References

Alexandratos, N., 1999. World food and agriculture: outlook for the medium and longer term. Proc. Natl. Acad. Sci. 96 (11), 5908–5914.
Amel-Zadeh, A., Serafeim, G., 2018. Why and how investors use ESG information: evidence from a global survey. Financ. Anal. J. 74 (3), 87–103.
Bager, S., et al., 2020. The Urgency of Action to Tackle Tropical Deforestation: Protecting Forests and Fostering Sustainable Agriculture.
Basiron, Y., 2007. Palm oil production through sustainable plantations. Eur. J. Lipid Sci. Technol. 109 (4), 289–295.
Brooks, T.M., et al., 2015. Harnessing biodiversity and conservation knowledge products to track the Aichi Targets and Sustainable Development Goals. Biodiversity 16 (2–3), 157–174.
Butchart, S.H., et al., 2004. Measuring global trends in the status of biodiversity: Red List Indices for birds. PLoS Biol. 2 (12), e383.
Butchart, S.H., et al., 2007. Improvements to the red list index. PLoS One 2 (1), e140.
Byerlee, D., Falcon, W.P., Naylor, R., 2017. The tropical oil crop revolution: food, feed, fuel, and forests. 1st ed. Oxford: Oxford University Press.
Ceres and Climate Advisors, 2017. Engage the Chain, Case study series: business risks from deforestation.
Chen, J., 2018. Market Capitalization. [cited 2019 18 August]; Available from:. https://www.investopedia.com/terms/m/marketcapitalization.asp.

Colchester, M., et al., 2006. Palm oil and land acquisition in Indonesia: Implications for local communities and indigenous peoples. Moreton-in-Marsh (UK): Forest Peoples Programme, Sawit Watch, p. 197.

Collen, B., et al., 2009. Monitoring change in vertebrate abundance: the living planet index. Conserv. Biol. 23 (2), 317–327.

Dirzo, R., Raven, P.H., 2003. Global state of biodiversity and loss. Annu. Rev. Environ. Resour. 28.

Dyck, A., et al., 2019. Do institutional investors drive corporate social responsibility? Int. Evid. J. Fin. Economics 131 (3), 693–714.

Feintrenie, L., 2014. Agro-industrial plantations in Central Africa, risks and opportunities. Biodivers. Conserv. **v. 23** (6), 1577–1589.

Fitzherbert, E.B., et al., 2008. How will oil palm expansion affect biodiversity? Trends Ecol. Evol. 23 (10), 538–545.

Foley, J.A., et al., 2005. *Global consequences of land use.* science. **309** (5734), 570–574.

Foley, J.A., et al., 2011. Solutions for a cultivated planet. Nature 478 (7369), 337.

Foster, W.A., et al., 2011. Establishing the evidence base for maintaining biodiversity and ecosystem function in the oil palm landscapes of South East Asia. Philosoph. Transac. Royal Society B: Biol.l Sci. 366 (1582), 3277–3291.

Gaveau, D.L., 2017. What a difference 4 decades make: Deforestation in Borneo since 1973. Center for International Forestry Research (CIFOR), Bogor, Indonesia.

Gaveau, D.L., et al., 2016. Rapid conversions and avoided deforestation: examining four decades of industrial plantation expansion in Borneo. Sci. Rep. 6, 32017.

Gibbs, H.K., et al., 2010. Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. Proc. Natl. Acad. Sci. 107 (38), 16732–16737.

Godfray, H.C.J., et al., 2010. Food security: the challenge of feeding 9 billion people. Science 327 (5967), 812–818.

Grooten, M., Almond, R., 2018. Living Planet Report–2018: Aiming Higher. WWF, Gland, Switzerland, pp. 22–100.

Henders, S., Persson, U.M., Kastner, T., 2015. Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. Environ. Res. Lett. 10 (12), 125012.

Henisz, W.J., McGlinch, J., 2019. ESG, material credit events, and credit risk. J. Appl. Corporate Fin. 31 (2), 105–117.

Hoffmann, M., et al., 2011. The changing fates of the world's mammals. Philosoph. Transac. Royal Society B: Biol.l Sci. 366 (1578), 2598–2610.

Jansson, M., Biel, A., 2014. Investment Institutions' Beliefs about and Attitudes toward Socially Responsible Investment (SRI): A Comparison between SRI and non-SRI Management. Sustainable Investment Research Platform, Sustainable Investment and Corporate Governance Working Papers, p. 22.

Johnston, M. and T. Holloway, *A global comparison of national biodiesel production potentials.* 2007, ACS Publications.

Kastner, T., Erb, K.-H., Haberl, H., 2014. Rapid growth in agricultural trade: effects on global area efficiency and the role of management. Environ. Res. Lett. 9 (3), 034015.

Kissinger, G., Herold, M., De Sy, V., 2012. Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers.

Lambin, E.F., et al., 2018. The role of supply-chain initiatives in reducing deforestation. Nat. Clim. Chang. 8 (2), 109.

Lee, B.X., et al., 2016. Transforming our world: implementing the 2030 agenda through sustainable development goal indicators. J. Public Health Policy 37 (1), 13–31.

Loh, J., et al., 2005. The living planet index: using species population time series to track trends in biodiversity. Philosoph. Transac. Royal Society B: Biol.l Sci. 360 (1454), 289–295.

Maddox, T., 2007. The Conservation of Tigers and Other Wildlife in Oil Palm Plantations: Jambi Province, Sumatra, Indonesia. Zoological Society of London (October 2007).

Meijaard, E., et al., 2018. Oil Palm and Biodiversity. A situation analysis by the IUCN Oil Palm Task Force.

Meijaard, E., et al., 2020. The environmental impacts of palm oil in context. Nature Plants 6 (12), 1418–1426.

Murphy, D.J., 2014. The future of oil palm as a major global crop: opportunities and challenges. J Oil Palm Res 26 (1), 1–24.

Packard Foundation, 2019. Grants and Investments. [cited 2019 18 August]; Available from:. https://www.packard.org/grants-and-investments/grants-database/zoological-society-of-london-5/.

Pimm, S.L., Raven, P., 2000. Biodiversity: extinction by numbers. Nature 403 (6772), 843.

Pittman, A., et al., 2013. NASA satellite data used to study the impact of oil palm expansion across Indonesian Borneo. Earth Observ. 25 (5), 12–15.

Potapov, P., et al., 2017. The last frontiers of wilderness: tracking loss of intact forest landscapes from 2000 to 2013. Sci. Adv. 3 (1), e1600821.

Rodrigues, A.S., et al., 2014. Spatially explicit trends in the global conservation status of vertebrates. PLoS One 9 (11), e113934.

RSPO, 2018. Principles and Criteria: For the Production of Sustainable Palm Oil. [cited 2019 9 August]; Available from:. https://rspo.org/resources.

RSPO, 2021. Impact. [cited 2021 26/03/21]; Available from:. https://rspo.org/impact.

SPOTT, 2019. Assessment scores explained. [cited 2019 15 August]; Available from:. https://www.spott.org/assessment-scores-explained/.

SPOTT. New Companies Selected for Assessment in, 2018. [cited2019 6 August]; Available from:. https://www.spott.org/news/new-companies-selected-spott-assessment-2018/.

Tan, K., et al., 2009. Palm oil: addressing issues and towards sustainable development. Renew. Sust. Energ. Rev. 13 (2), 420–427.

Tilman, D., et al., 2011. Global food demand and the sustainable intensification of agriculture. Proc. Natl. Acad. Sci. 108 (50), 20260–20264.

UN, 2015. Transforming Our World: The 2030 Agenda for Sustainable Development UN: New York.

Villela, A., et al., 2014. Status and prospects of oil palm in the Brazilian Amazon. Biomass Bioenergy 67, 270–278.

Wearn, O.R., et al., 2016. Grain-dependent responses of mammalian diversity to land use and the implications for conservation set-aside. Ecol. Appl. 26 (5), 1409–1420.

Wicke, B., et al., 2008. Different palm oil production systems for energy purposes and their greenhouse gas implications. Biomass Bioenergy 32 (12), 1322–1337.