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The role of third-party audits in ensuring producer compliance with the Roundtable on Sustainable Palm Oil (RSPO) certification system

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E-mail: kimcarlson@gmail.com**Keywords:** Indonesia, transparency, governance, corporate social responsibility, private voluntary regulationSupplementary material for this article is available [online](#)**Abstract**

Certification systems for sustainable agricultural commodities typically rely on auditors to verify that producers comply with environmental, social, and legal standards. In the oil palm industry, the Roundtable on Sustainable Palm Oil (RSPO) certification system promises to address core sectoral sustainability concerns—including deforestation, fire, biodiversity loss, peatland drainage, forced labor, and land tenure conflict—by applying third-party audits to large-scale oil palm growers. Audits are designed to detect noncompliances with the standard, and to ensure that growers resolve these nonconformities. Yet, the role of RSPO audits in generating additionality across key sustainability issues remains unclear. Here, we compiled and analyzed data from a timeseries of annual audit reports for two-thirds of all certified oil palm growers in Indonesia as of December 2015 ($n = 114$ certified growers and 262 reports). We found that certified growers were required to address a median of four noncompliances per audit (range 0–37), with more noncompliances detected at initial certification than during subsequent audits. Certification demanded the most changes under our thematic areas of Waste & Pollution (9% of all noncompliances) and Employment (7%) and the least changes in Fire (<1%) and Corporate Social Responsibility programs (<1%). Thus, while many RSPO certified growers make real changes to achieve certification, these changes do not always address core sectoral performance concerns. Regression analysis indicated that RSPO member and certification body were significantly correlated with noncompliance frequency. This suggests that each member has a different cost of compliance and indicates heterogeneous stringency of standard application by certification bodies. We recommend that future research evaluate how post-2015 changes in RSPO assurance processes have interacted with a more robust and comprehensive certification standard to alter the additionality from third-party audits.

1. Introduction

Voluntary sustainability certification systems have arisen in response to global activism and recognition of the business case for corporate environmental responsibility in the face of shortcomings in public governance [1]. They are among the most mature of voluntary efforts that promote sustainable production of tropical agricultural commodities

such as soybean, oil palm, and coffee [2, 3]. However, the effectiveness of these systems at addressing major sustainability concerns around tropical commodity crop agriculture, including deforestation [4], human rights violations [5], benefits for smallholders [6], and biodiversity loss [7–9] has been questioned, and they have been criticized as weak instruments that enable greenwashing [10–12].

Limited effectiveness of voluntary certification can be traced to several factors [13]. First, the rate and distribution of certification adoption across space, time, and actors define the degree to which change is possible [14]. Low rates of adoption are common among the most stringent certification standards, and adoption is often skewed toward producers who are already performing close to the standard. Second, the standard itself defines the minimum performance that participants must achieve. If a standard misses major sustainability concerns, has low stringency [15], or vague definitions [16], it may not generate much positive change even if widely adopted. Voluntary standard stringency is intrinsically limited because it is a negotiation between civil society and producers, who will not participate if a standard is too rigorous [17]. Third, the monitoring, verification, and enforcement of compliance with the standard is necessary to ensure full implementation by producers. When a certification system lacks procedures to detect or provide meaningful consequences for noncompliance—when a producer fails to conform with the standard—it may generate little additionality.

Most leading certification systems applied to tropical commodities use third-party audits performed by independent accredited certification bodies to verify compliance with certification standards [18]. This approach is designed to minimize conflicts of interest between certification systems and entities seeking certification [19, 20]. Despite the critical role of such audits in determining certification system effectiveness, little tropical commodity certification research has focused on the audit process. Instead, researchers have mainly evaluated adoption [e.g. 21], the robustness of written certification standards and governance systems [e.g. 22, 23], and outcomes [e.g. 6, 24]. Yet, identifying what changes are requested by auditors and how these changes map onto key areas of concern for sustainable commodity production is necessary to link observed outcomes to the certification system's design and adoption, and thus to evaluate overall effectiveness [25]. Such information informs certification system improvement, corporate decisions to adopt certification or purchase certified products, government engagement or appropriation of system approaches, and civil society advocacy strategies. Analysis of changes in producer practices required by auditors is one way to address this knowledge gap [26–28].

Research into changes made by producers is particularly needed for palm oil, which in 2019 supplied around 40% of all vegetable oil [29]. Palm oil is produced both on large-scale plantations run by large, capitalized 'grower' companies as well as on small farms managed by family farmers. Core sustainability concerns in the sector include biodiversity loss and greenhouse gas emissions from oil palm expansion into forests and peat soils [30–33], fire and smoke

[34], forced labor on large-scale plantations [5, 35], and land conflict with and loss of traditional livelihoods by rural communities [36].

To address these concerns, the multi-stakeholder Roundtable on Sustainable Palm Oil (RSPO) was founded in 2004 [37]. The RSPO requires that members with oil palm production activities become certified by conforming to a set of principles and criteria (P&C) which have been agreed upon by all members. By 2022, 19% of global palm oil supply was produced under this RSPO standard [38]. Yet, the RSPO's own research suggests that its auditing system for large-scale growers misses a substantial number of noncompliances across critical sustainability areas, including labor practices and relationships with communities [39–41]. These RSPO-led analyses rely solely on the P&C to categorize noncompliances, rather than using the unique description of the non-compliance provided in the audit report. Since the P&C category does not always indicate the underlying cause of a noncompliance, this approach limits evaluation of how noncompliances are distributed across core sustainability concerns in the oil palm sector. Moreover, factors driving noncompliance detection rates remain largely unexplored.

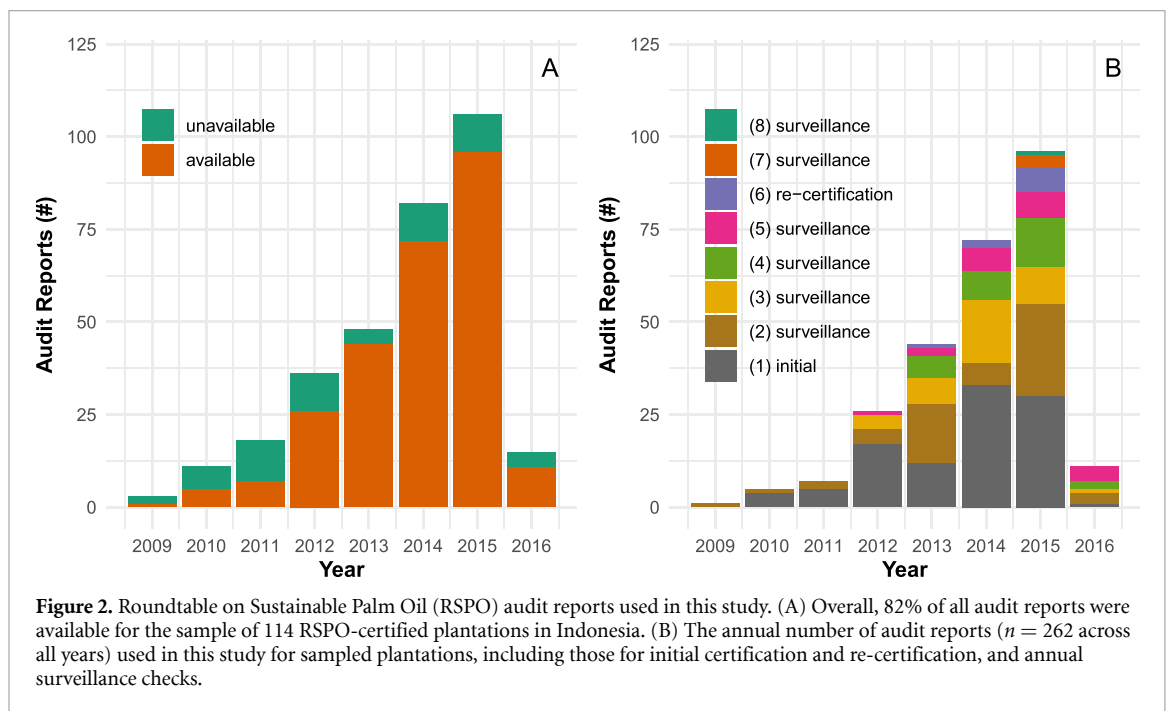
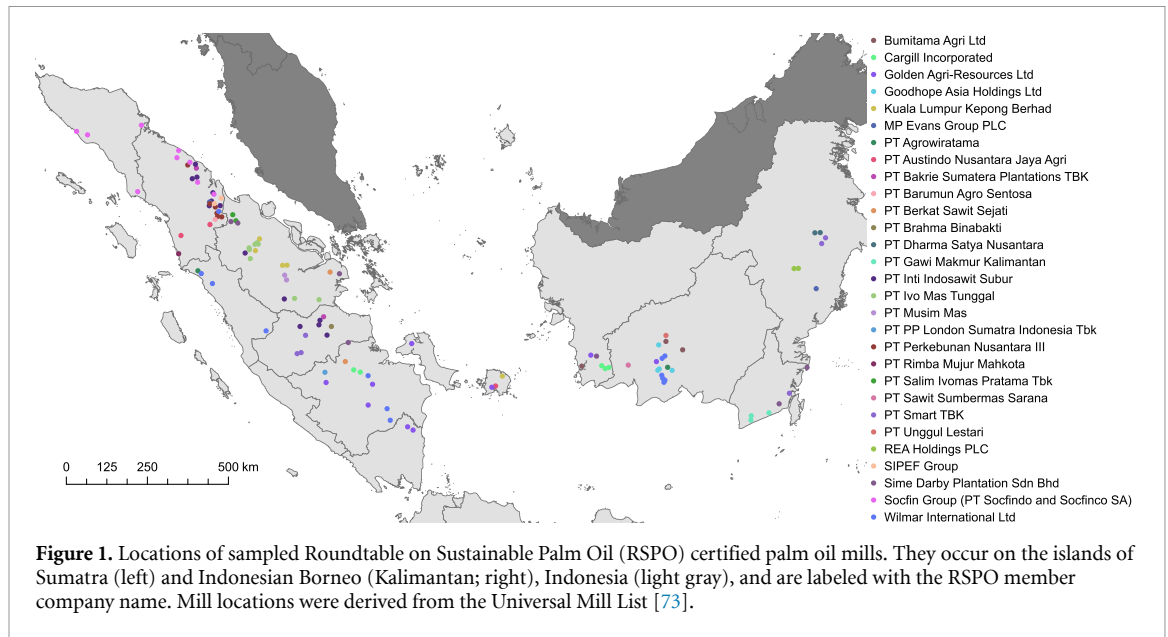
Given the importance of understanding how the third-party auditing process interacts with adoption and standard stringency and scope to generate overall certification system effectiveness, here we investigate the changes made due to the RSPO third-party auditing process by addressing the following questions: (a) to gain and maintain RSPO certification, how many and what kind of changes must oil palm companies make? (b) How do these changes relate to core sustainability concerns in the oil palm sector? and (c) Which factors influence audit-induced changes?

To answer these questions, we compiled and analyzed data on noncompliances from a sample of audit reports through 2015 for certified oil palm grower companies. We evaluated growers in Indonesia, the leading producer of palm oil (57% of global palm oil production in 2019) and RSPO certified palm oil (83% of global production in 2022) [29, 38]. Results inform whether and how the third-party auditing process drives environmental and social changes, which are components of overall effectiveness of private voluntary supply chain regulation via certification systems.

2. Methods

2.1. Certified industrial grower selection

We compiled a list of all industrial growers in Indonesia that were awarded their first RSPO certificate by December 2015 from the RSPO website ($n = 173$ growers) [42]. Because most of these growers (98%, $n = 170$ growers) were located within Sumatra and Kalimantan (Indonesian Borneo), we randomly



selected about two thirds (114 growers) from these two regions for analysis (figure 1).

2.2. Certification document collection

For each selected certified grower unit, we compiled all available audit reports (i.e. initial assessments, annual surveillance assessments, and re-certifications) and certificates of conformance from initial certification through 31 December 2015 from the RSPO website. When a document was not available from the RSPO website, we searched for it using the Google search engine or requested it from the RSPO secretariat. We analyzed 102 initial assessment reports, 150 annual surveillance reports, and 10 re-certification reports. Our database included

82% of all possible audit documents (figure 2). Our sample misses audit reports published after 2015, including measures of compliance against the more stringent 2018 international standard [43]. However, the ‘checklist governance’ approach [44] is still used in this most recent standard revision, suggesting that our research remains relevant.

2.3. P&C coding

Auditors assessed producers against international standards published in 2007 [45] or 2013 [46], or the 2008 Indonesian national interpretation of the 2007 international standard [47]. The Indonesian interpretation references laws and regulations unique to Indonesia but has the same P&C as the

Table 1. Example of noncompliance identification and resolution from a sampled audit report, using the Roundtable on Sustainable Palm Oil 2013 International Standard, Principle 5, Criterion 5.2, Indicator 5.2.2 which is designated as a ‘major’ indicator. HCV = High Conservation Value.

Source	Component	Text
Standard	Principle	Environmental responsibility and conservation of natural resources and biodiversity
	Criterion	The status of rare, threatened or endangered species and other high conservation value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and operations managed to best ensure that they are maintained and/or enhanced.
	Indicator (Major)	Where rare, threatened or endangered (RTE) species, or HCVs, are present or are affected by plantation or mill operations, appropriate measures that are expected to maintain and/or enhance them shall be implemented through a management plan.
Audit report	Noncompliance	A step-by-step protection procedure for extinct or endangered species is already available, but does not include the observation on the types of species identified and their habitat.
	Resolution	The company, represented by the personnel from HCV management, has conducted an observation on the species regarded as protected, extinct/endangered.

international standard, and we thus considered the 2008 national interpretation equivalent to the 2007 international standard.

The 2007 and 2013 standards contain significant differences. The 2007 standard is composed of 8 Principles and 39 Criteria. The 2013 standard includes the original eight Principles, adds four new Criteria, and uses Indicators as evidence that Criteria are being met. Thus, the 2013 standard has 43 Criteria measured by 129 Indicators which are pre-classified as major or minor (e.g. table 1), although auditors sometimes re-categorized noncompliances despite these classifications. Because the 2007 standard lacked Indicators, the bulk of our analysis considered only Principles and Criteria.

2.4. Audit data collection

From these audit reports, we constructed a database of RSPO-certified mills and associated noncompliances. We also collected information about factors that may affect the frequency and/or intensity of noncompliances.

For the mill, we recorded RSPO member name, province, date of initial certification, and year of initial oil palm planting. For each audit, we recorded the certification body, audit type (e.g. initial certification), certificate publication year, RSPO standard (2007 or 2013), supply chain model (mass balance, identity preserved, or segregated), total supply base area (hectares), the number of auditors, and audit start and end dates. We coded certification body by international group rather than individual corporation within a group (e.g. TÜV NORD represented both PT TÜV NORD Indonesia and TÜV NORD INTEGRA bvba).

For each noncompliance, we noted the intensity of the noncompliance (major or minor) designated by the auditor. Failure to conform with

major noncompliances impacts achievement of the objectives of the standard, whereas nonconformance with minor indicators has only temporary non-systematic impacts. Major noncompliances must be resolved within 90 days, and all major noncompliances must be resolved to gain initial certification. For minor noncompliances, the producer has until the next surveillance assessment to comply, otherwise the issue will be raised to the major category. We also recorded ‘observations,’ which typically highlight potential issues not yet severe enough to warrant a noncompliance.

We recorded the date of the noncompliance and its resolution, when available. When a noncompliance was closed before the report was published, we recorded the days to close as zero. Our analysis of time to close is reported in supplementary text section 1.4. We linked each noncompliance with a Principle, Criterion, and Indicator. When more than one Principle, Criterion, and/or Indicator was associated with a single noncompliance, we linked the noncompliance record to the first Principle-Criterion-Indicator combination. We also collected the text description of the noncompliance.

2.5. Identification of issues addressed through auditing

To identify the types of issues addressed through resolution of noncompliances, we classified noncompliances into 33 thematic areas (table S1). To do so, we read each noncompliance and assigned it to a thematic area, following Newsom, Bahn [26]. In instances when multiple thematic areas were detected for one noncompliance, we selected the thematic area that we felt represented the main reason for the noncompliance.

We then classified these thematic areas into five general classes (Environment, Social, Health

& Wellbeing, Labor & Employment, and Management; table S1) following similar studies [26, 28, 48]. Noncompliances in the Environment category are related to on the ground practices that may have had an impact on the surrounding environment. Social issues affect the humans involved in oil palm production as well as communities near the plantation. The Health & Wellbeing category includes noncompliances related to human health including occupational health and safety. The Labor & Employment class includes issues related to people who work for or are contracted by the oil palm company. Finally, Management comprises noncompliances related to the operation of the plantation and mill.

2.6. Analysis

All statistical analysis was performed in R [49]. We built models to identify factors related to the number of noncompliances per audit. Total noncompliance results are reported in the main text, while major and minor noncompliance and observation results are described in supplementary text section 1.2. Because our dependent variable represents count data and is over-dispersed, we applied negative binomial regression. We used the *glm.nb* function from the *MASS* package [50] to explore the effect of a suite of factors (table 2) on the frequency of noncompliances. Auditing effort was log-transformed for use in models because its distribution was right-skewed. We carried out type-II analysis of variance tests using a likelihood ratio approach with the *Anova* function from the *car* package [51] to assess the significance of various predictor variables. We measured model significance and pseudo r^2 values using the *nagelkerke* function from the *rcompanion* package [52]. To qualitatively assess heterogeneity in noncompliance themes, we summarized noncompliance density (noncompliances per audit) by thematic area across factors significantly related to the total number of noncompliances per audit.

3. Results and discussion

3.1. Spatio-temporal distribution of RSPO-certified oil palm growers

Our sample of certified oil palm growers was dominated by plantations that were developed long before the RSPO was founded. The median initial oil palm planting year was 1993 (range 1975–2009) and the median certification year was 2014 (range 2009–2015). Initial planting year was not a significant predictor of noncompliance rate (table 3, figure S1). These findings align with previous research suggesting that in Indonesia, RSPO-certified oil palm plantations tend to be older than average [4]. While the RSPO does require that members eventually certify all their mills, most members do not seek certification of all their qualifying holdings at once. Instead,

they may focus on those that are closest to achieving the RSPO standard, which are most likely to be older plantations. Plantations fully developed before 2005 are not subject to restrictions on development of forest, peatland, and High Conservation Values contained in the RSPO standard. Moreover, older plantations have had more time to address land conflicts, establish full legal land rights, and train employees.

Selected growers spanned 12 provinces, with most located on the island of Sumatra, where the oil palm industry is most established (figure 1, table S2). Across provinces, Aceh stood out with the most noncompliances per audit while East Kalimantan had the least (figure 3), but there were no clear trends in noncompliance themes across provinces (figure S2). Mill location was significantly related to total noncompliances per audit (table 3), potentially because provinces have distinct histories of plantation development, legal contexts, and biogeographic and socioeconomic characteristics that shape oil palm development trajectories.

3.2. Noncompliance frequency across growers

The number and type of noncompliances represents the additionality generated through auditing, where a greater number of more severe noncompliances detected by auditors and resolved by companies equates to greater change. Certified growers were required to address a median of four noncompliances per audit (range 0–37). Growers incurred fewer major noncompliances (median 1, range 0–17 per audit) than minor noncompliances (median 2, range 0–32) and observations (median 3, range 0–27; figure S3). About 22% of all audits reported zero noncompliances (table S3). However, the number of noncompliances reported by certification bodies likely underestimates total noncompliances. Witnessed RSPO audits, where certification bodies are accompanied by observers, have generated twice as many noncompliances as standard audits [41].

3.3. Temporal trends in noncompliance identification

Producers made more changes to their practices during initial certification than during annual surveillance audits and at re-certification (figure 3). Similar temporal patterns were reported by Newsom, Bahn [26] in their analysis of the Forest Stewardship Council Smartwood program. Both initial and re-certification involve more thorough auditing than annual surveillance, which is intended to monitor past noncompliances and review continuous improvement. Noncompliances reported during annual surveillance might thus be driven by the requirement that certified units continuously update practices and improve performance, but could also be due to variation in standard interpretation between auditors, detection of issues that were present but not discovered in a previous audit, raising an observation

Table 2. Factors that potentially affect noncompliance number and type, along with their definitions and justifications for inclusion in this study.

Variable	Data type	Definition	Justification
Audit category	Categorical	The type of audit conducted (i.e. initial certification assessment, re-certification, and assessments that occur annual in years that the grower is not undergoing certification)	The audit category allows evaluation of whether and how the type of audit affects noncompliance detection
RSPO member	Categorical	The RSPO member company that owns the mill	Variation in noncompliances between members may suggest different costs of certification and heterogeneous changes needed to achieve certification
RSPO standard	Categorical	The set of Principles and Criteria used for evaluation: 2007 or 2013	The standard partly defines stringency and scope of the certification system and differences in standard content may thus influence changes required by producers; auditing against a revised standard may require additional changes from the producer
Mill location	Categorical	The Indonesian province where the certified mill is located	The geographic location of the mill may influence noncompliance type and number because different provinces have heterogeneous socio-political and environmental dynamics and conditions
Effort (person-days ha ⁻¹)	Continuous	The number of person-days to complete an audit divided by the total supply base area in hectares; we log-transformed this variable prior to analysis because it was right-skewed	Effort may serve as proxy for cost of certification, and more time spent auditing may be related to the likelihood of noncompliance detection
Supply chain model	Categorical	The supply chain model: identity preserved (IP, identifiable from mill to supply base), mass balance (MB, mixed with conventional palm oil during transport and storage), or segregated (SG, kept apart from conventional palm oil)	Because supply chain model indicates the type of relationship a mill has with its supply base (e.g. mostly owned by plantation versus mostly by another oil palm company), the model may be correlated with the type and number of noncompliances
Certificate year	Discrete	The year the grower received the certificate of conformance associated with the audit report (years 2009–2016)	Auditors may detect more or less problems over time due to changes in requirements for auditors, learning by companies, and other factors
Initial planting year	Discrete	The first year that oil palm was planted within the supply base (range 1975–2009)	Plantations of different ages may require different changes to their practices to achieve compliance with the P&C, because they were developed under variable legal environments and different stages of plantation development may be associated with different types of issues
Certification body	Categorical	The company hired to send licensed RSPO auditors to conduct audits	Characteristics of certification bodies including their goals (e.g. profit, conservation) may affect noncompliance detection

to a noncompliance, or becoming non-compliant after passing an initial audit [53].

Temporal trends in noncompliance detection varied across themes. For instance, Waste & Pollution, Employment, and Conservation had high initial detection rates and remained persistent through time, while others including Peat, Gender, and Corporate Social Responsibility were resolved mostly within the

first two years of certification (figure S4). These differences may be related to the ease in addressing the noncompliance and the durability of the solution. For example, in the Peat thematic area, many noncompliances and corrective actions related to measurement of peat subsidence, procedures that are relatively easy to maintain once in place. In contrast to most other themes, the Smallholder theme had

Table 3. Results from four negative binomial models (i.e. total, major, and minor noncompliances, and observations) relating noncompliance frequency to several predictor variables. All models were significant ($p < 0.001$). Predictor variable significance was measured with a type-II Anova with a likelihood-ratio approach. The analysis included 262 audits.

Statistic	Type	Total noncompliances	Major noncompliances	Minor noncompliances	Observations
Pseudo r^2	McFadden	0.18	0.21	0.19	0.17
	Nagelkerke	0.66	0.60	0.61	0.56
Predictor variable	Audit category	0.003	<0.001	0.327	0.110
	RSPO member	<0.001	<0.001	<0.001	<0.001
p -value	RSPO standard	0.799	0.338	0.569	0.454
	Mill location	0.017	0.697	<0.001	0.032
	Effort (person-days ha ⁻¹)	0.109	0.553	0.031	0.060
	Supply chain model	0.921	0.572	0.711	0.818
	Certificate year	0.270	0.099	0.003	0.336
	Initial planting year	0.806	0.923	0.494	0.323
	Certification body	0.004	0.038	<0.001	<0.001

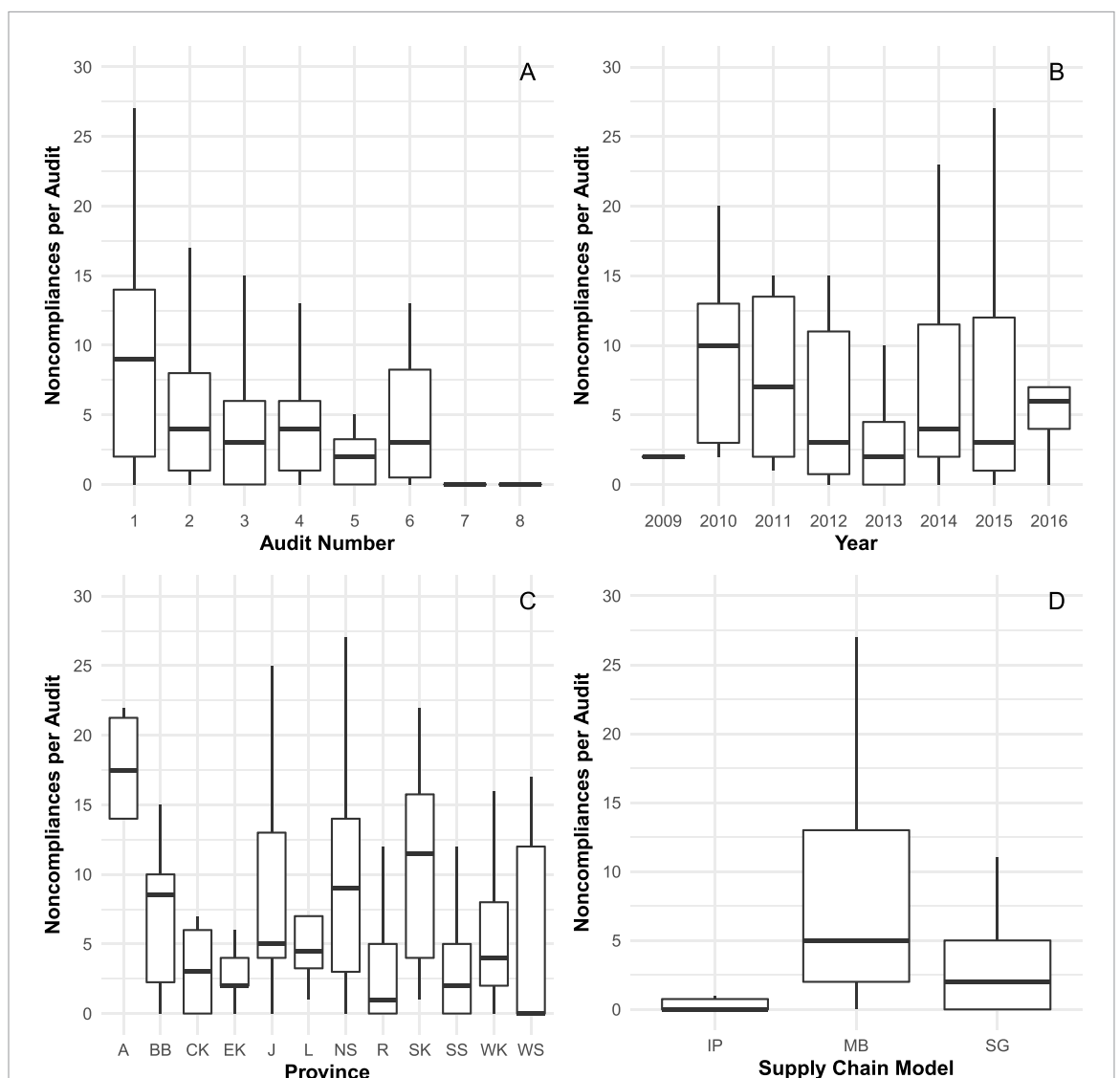
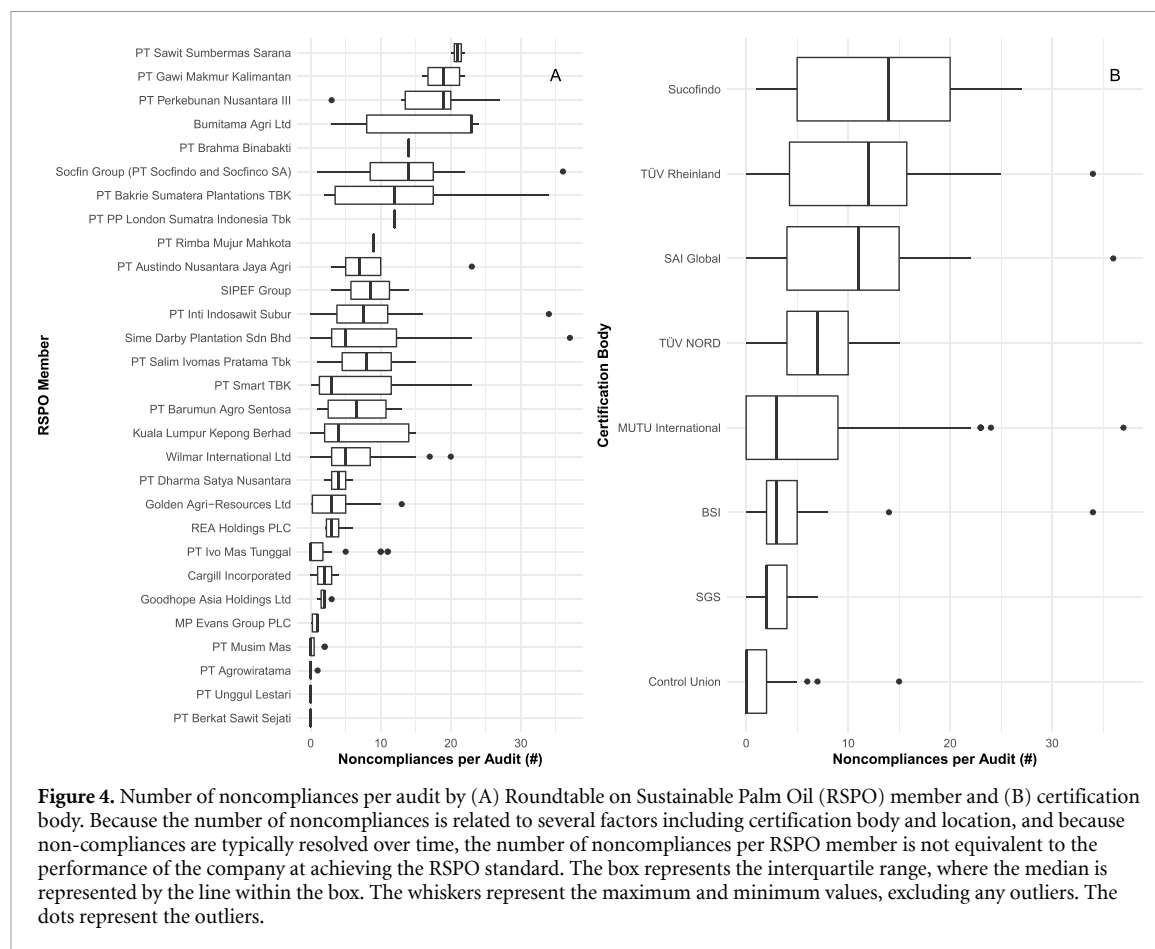


Figure 3. Distribution of Roundtable on Sustainable Palm Oil (RSPO) noncompliances per audit across (A) audit category, including initial certification (1), annual assessments (2–4, 6–7), and re-certification (5), (B) year of certificate, (C) province (A = Aceh, BB = Bangka Belitung, CK = Central Kalimantan, EK = East Kalimantan, J = Jambi, L = Lampung, NS = North Sumatra, R = Riau, SK = South Kalimantan, SS = South Sumatra, WK = West Kalimantan, WS = West Sumatra), and (D) supply chain model (IP = identify preserved, MB = mass balance, SG = segregated). The box represents the interquartile range, where the median is represented by the line within the box. The whiskers represent the maximum and minimum values. Outliers are not displayed.



highest noncompliance detection rates during surveillance years (figure S4), potentially because companies often certify their tied smallholders after initial mill certification.

Because the RSPO P&C are updated every five years, re-certification typically applies a new, more stringent standard. Several themes not frequently detected in the first certification period emerged at re-certification. These included: GHGs (greenhouse gasses) & Energy, likely in response to a new requirement that growers minimize GHG emissions from new plantings; FFB (fresh fruit bunch) Suppliers, linked to the new requirement that mills record the origins of palm oil fruit supply; and Transparency & Dissemination, in response to a new criterion on ethical business practices (figure S4) [54]. Despite increasing standard stringency over time, we detected no significant relationship between total noncompliance frequency and certificate year or RSPO standard (table 3, figure S1). Thus, any additionally gain generated from updating the standard is not detectable in our sample.

3.4. Noncompliance differences among RSPO members

Noncompliance frequency was significantly related to RSPO member ($n = 29$ members; table 3). Across

companies, Bumitama Agri Ltd, PT Sawit Sumbermas Sarana, PT Gawi Makmur Kalimantan, and PT Perkebunan Nusantara III had the most noncompliances (median of 19–23 noncompliances per audit; table S2). PT Ivo Mas Tunggal, PT Agrowiratama, PT Musim Mas, PT Berkat Sawit Sejati, and PT Unggul Lestari all had a median of zero noncompliances per audit (figure 4, table S2). Zero noncompliances were detected for 65%–100% of audits for these companies (table S3). Moreover, different RSPO members had to address distinct issues to achieve RSPO certification. For instance, Bumitama Agri Ltd had the greatest noncompliance rate in the Land Rights theme, PT Brahma Binabakti in Employment, and PT Sawit Sumbermas Sarana in GHGs & Energy (figure S5). Because audit category, mill location (province), and certification body were also significant predictors of total noncompliances (table 3), and because non-compliances are typically resolved over time, the rate of noncompliances per member does not necessarily reflect the performance of the organization at achieving the RSPO standard. Instead, this heterogeneity suggests that each RSPO member faces a different cost of compliance beyond the RSPO membership dues and auditing fees that all companies pay [55], and may reflect different degrees of member pre-audit preparation for certification.

3.5. Noncompliance differences among certification bodies

The significant relationship between certification body and noncompliance frequency ($n = 8$ certification bodies; table 3) indicates that the degree of change required to become certified depends not only on the RSPO member but also on the auditing company. Certification bodies Sucofindo, TÜV Rheinland, and SAI Global identified more noncompliances per audit (median 11–14) than others, while Control Union and SGS identified the fewest noncompliances (median of 0–2 per audit) (figure 4, table S2). Of all audits done by MUTU International and Control Union, 30% and 55%, respectively, had zero noncompliances, while no audits by Sucofindo had zero noncompliances (table S4). Certain certification bodies tended to flag particular thematic areas. For instance, MUTU International and SAI Global focused on Waste & Pollution, BSI issued the most noncompliances per audit regarding Smallholders, and Sucofindo had the highest noncompliance density in the Employment theme (figure S6). Auditor effort (supplementary text section 1.1) was not a significant predictor of total non-compliances (table 3, figure S1).

The substantial variation in noncompliance detection among certification bodies after controlling for other sources of variation is likely related to audit quality, audit competence, and auditor independence. Regarding quality and competence, especially in the initial years of application of the RSPO standard, auditors had to quickly learn how to implement the standard and the RSPO was still determining how to effectively train auditors. Thus, different interpretations of the P&C across auditors with different competencies may be a source of heterogeneity [56]. With respect to independence, RSPO members can choose from a selection of qualified certification bodies. As a result, auditors may have a hard time remaining objective and impartial [57], and activist reports suggest they may intentionally collude with companies [12, 58, 59].

In recent years, the RSPO has worked to improve its quality assurance process [56]. Starting in 2010, the RSPO began the process of ensuring that all certification bodies be accredited by an international accreditation body (Accreditation Services International (ASI)) to support impartiality [60]. Since 2014, ASI has issued sanctions to most certification bodies included in this study (except TÜV Nord and BSI), including temporary suspensions or full termination for problems such as lack of evidence for corrective actions to resolve noncompliances [61]. Moreover, revisions to the standard in 2018 were meant to improve consistency among auditors [43]. If such efforts have been effective, certification body importance in driving noncompliance frequency should decline or disappear with time.

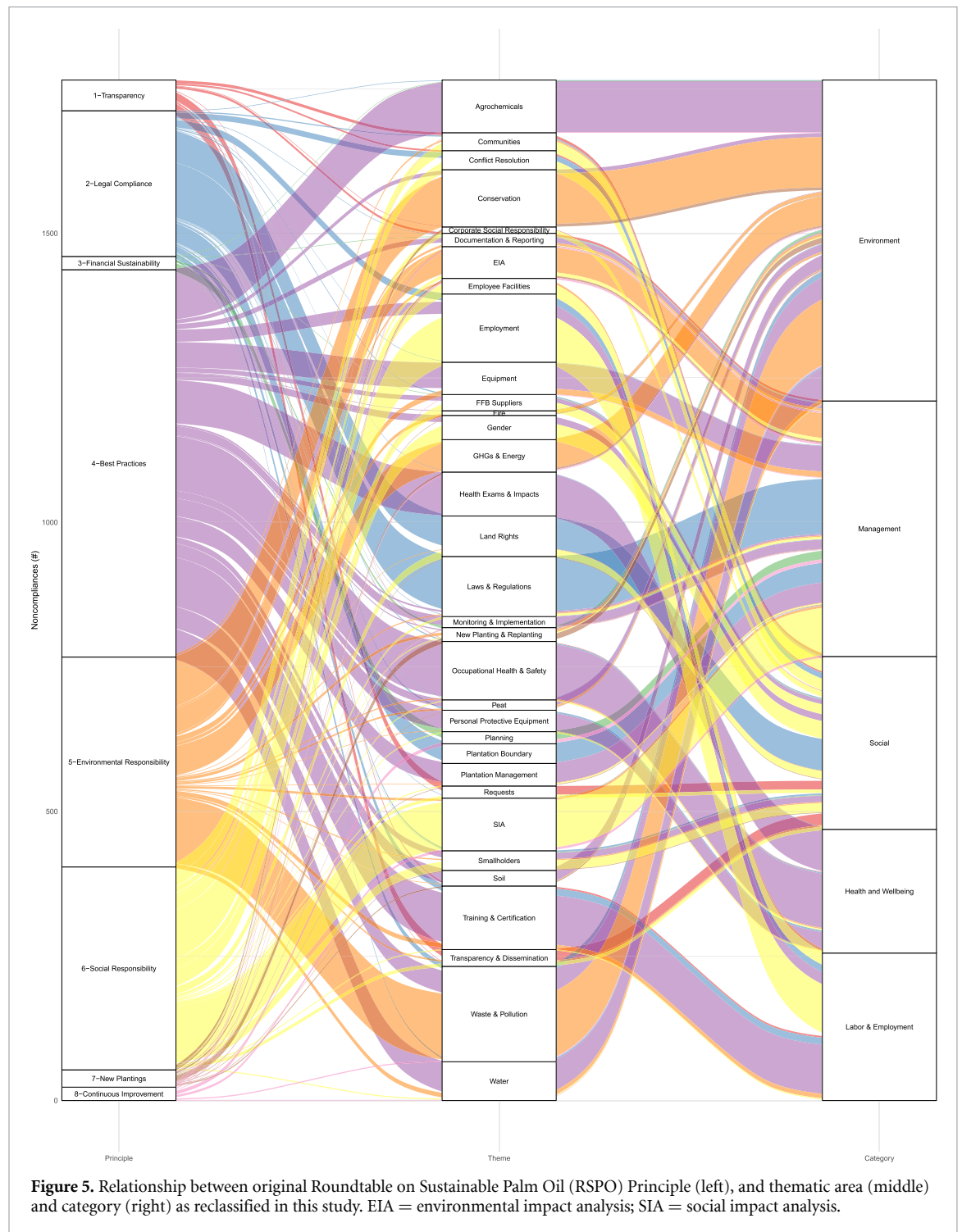
3.6. Types of sustainability issues addressed through certification

RSPO certification demanded the most changes in our Environment category (31%), followed by Management (25%), Social (17%), Labor and Employment (14%), and Health & Wellbeing (12%; figure 5, table 4). The distribution of noncompliances across Principles and Criteria is reported in supplementary text section 1.3. We found that the number of Criteria and Indicators per Principle were positively related to the number of detected noncompliances (figure 6). Below, we discuss general trends in the content and resolution of the top ten noncompliance themes and connect them to available empirical evidence for changes induced by RSPO certification.

3.6.1. Environment

The most frequent noncompliance theme was Waste & Pollution (9.3% of all noncompliances; figure 5, table 4), which is not a critical international sustainability concern in the oil palm sector. Many nonconformities within this category referenced improper solid waste handling including storage, disposal, and documentation. To resolve such issues, companies often changed their waste management practices or provided required documentation. Addressing these noncompliances may have contributed to the reduced land pollution in communities near certified oil palm plantations in Kalimantan observed by Lee, Miteva [62].

The Conservation theme comprised 5.6% of all noncompliances (table 4) and was the most-referenced theme at re-certification (figure S4). This theme included diverse noncompliance descriptions, spanning lack of demarcation, monitoring, and appropriate management of High Conservation Value areas, insufficient training of personnel and education of community members, and conformance of High Conservation Value documentation with minimum standards. In some cases, changes made to address noncompliances apparently led to real changes in land cover (e.g. ‘[...] revegetation of buffer zone around the river borders [...]’) and in others company activities may have indirectly supported conservation (e.g. ‘Socialization towards the employees and surrounding community about the conservation of protected species’). Several studies finding significant additional conservation of forests within certified concessions imply that such changes result in measurable conservation outcomes [4, 62, 63]. Yet, auditors rarely flagged Fire, Peat, and New Planting—the direct cause of deforestation from oil palm—as noncompliances (<2% for each theme; table 4). Although these issues are at the core of concerns around the environmental sustainability of palm oil, they are typically tied to recent oil palm expansion, which is uncommon among RSPO certified growers [4].



3.6.2. Health and wellbeing

About 5.7% of all noncompliances fell into the Occupational Health & Safety theme (table 4). These diverse problems included lack of work accident reporting, unsatisfactory risk assessment, and insufficient provision of first aid kits to employees. Auditors frequently (4.3% of all noncompliances, table 4) recommended health exams for employees. For instance, companies were often required to show results of spirometry tests for workers at high risk of lung disease. It is unclear whether these procedural changes translated into

real benefits for the wellbeing of workers and communities. To our knowledge, no researchers have assessed changes in worker health from RSPO certification.

3.6.3. Labor and employment

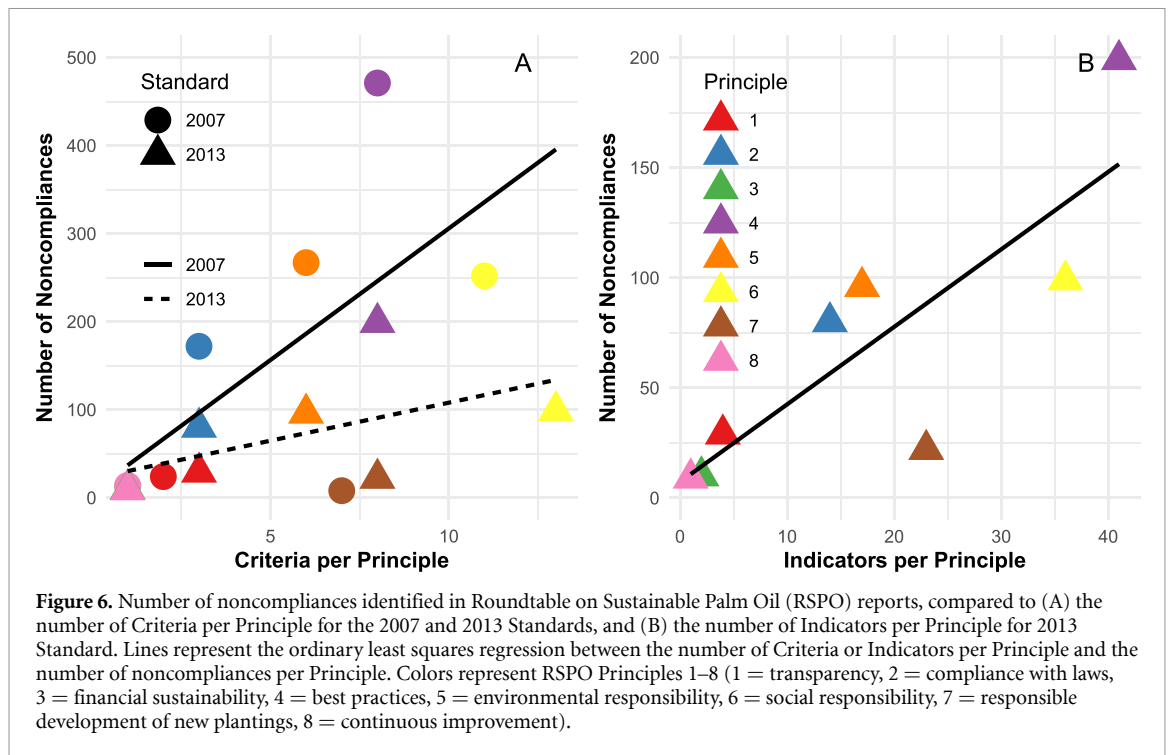
The Employment theme contributed 6.7% of all noncompliances (table 4). Noncompliances in this category often addressed legally mandated benefits for workers such as insurance and wages, and companies resolved these issues by extending benefits to workers. Several audits found that companies should

Table 4. The frequency of major, minor, and total (major + minor) noncompliances grouped by category and thematic area.

Category	Thematic area	Major		Minor		Total	
		#	%	#	%	#	%
Environment	Agrochemicals	50	6.5	42	4.2	92	5.2
	Conservation	50	6.5	49	4.9	99	5.6
	Fire	3	0.4	5	0.5	8	0.5
	GHGs & Energy	19	2.5	37	3.7	56	3.2
	New Planting & Replanting	17	2.2	7	0.7	24	1.4
	Peat	9	1.2	9	0.9	18	1.0
	Soil	4	0.5	23	2.3	27	1.5
	Waste & Pollution	74	9.6	91	9.1	165	9.3
	Water	13	1.7	54	5.4	67	3.8
	<i>Subtotal</i>	<i>239</i>	<i>31.0</i>	<i>317</i>	<i>31.9</i>	<i>556</i>	<i>31.5</i>
Health & Wellbeing	Health Exams & Impacts	16	2.1	60	6.0	76	4.3
	Occupational Health & Safety	34	4.4	67	6.7	101	5.7
	Personal Protective Equipment	20	2.6	17	1.7	37	2.1
	<i>Subtotal</i>	<i>70</i>	<i>9.1</i>	<i>144</i>	<i>14.5</i>	<i>214</i>	<i>12.1</i>
Labor & Employment	Employee Facilities	4	0.5	23	2.3	27	1.5
	Employment	50	6.5	68	6.8	118	6.7
	Training & Certification	53	6.9	57	5.7	110	6.2
	<i>Subtotal</i>	<i>107</i>	<i>13.9</i>	<i>148</i>	<i>14.9</i>	<i>255</i>	<i>14.4</i>
Management	Documentation & Reporting	13	1.7	11	1.1	24	1.4
	Environmental Impact Assessment, Management, & Monitoring	30	3.9	25	2.5	55	3.1
	Equipment	11	1.4	45	4.5	56	3.2
	Laws & Regulations	63	8.2	41	4.1	104	5.9
	Monitoring & Implementation	5	0.6	14	1.4	19	1.1
	Planning	21	2.7	0	0.0	21	1.2
	Plantation Boundary	22	2.8	12	1.2	34	1.9
	Plantation Management	12	1.6	27	2.7	39	2.2
	Social Impact Assessment, Management, & Monitoring	33	4.3	58	5.8	91	5.1
	<i>Subtotal</i>	<i>210</i>	<i>27.2</i>	<i>233</i>	<i>23.4</i>	<i>443</i>	<i>25.1</i>
Social	Communities	13	1.7	18	1.8	31	1.8
	Conflict Resolution	17	2.2	16	1.6	33	1.9
	Corporate Social Responsibility	2	0.3	9	0.9	11	0.6
	FFB Suppliers	10	1.3	18	1.8	28	1.6
	Gender	9	1.2	33	3.3	42	2.4
	Land Rights	56	7.3	14	1.4	70	4.0
	Requests	15	1.9	6	0.6	21	1.2
	Smallholders	9	1.2	25	2.5	34	1.9
	Transparency & Dissemination	15	1.9	14	1.4	29	1.6
	<i>Subtotal</i>	<i>146</i>	<i>18.9</i>	<i>153</i>	<i>15.4</i>	<i>299</i>	<i>16.9</i>
	TOTAL	772	100	995	100	1767	100

offer workers full time contracts in accordance with Indonesian law. In response, companies upgraded workers to permanent status. Many other noncompliances related to underage workers or discriminatory hiring practices, and resolution often relied on revision or dissemination of company policies. In other cases, Employment noncompliances focused on records and information, such as provision of written contracts to workers and meetings with labor unions. These were resolved by documenting

missing information or actions. Despite the substantial emphasis on employment by auditors, and the changes made to comply with both legal and certification standards due to auditing, RSPO-certified growers have been accused of forced labor, child labor, and failure to pay minimum wages [5, 35]. Moreover, recent audits of certification body performance suggest that treatment of workers comprises about two-thirds of noncompliances *not* detected by auditors [41].



Training and certification of staff and contractors was also a leading theme (6.2% of all noncompliances, table 4), and these noncompliances included a lack of legally mandated certifications, training on RSPO-specific requirements, and insufficient documentation of training. In many cases, these problems were addressed via documentation of additional training or required certifications. Training may support improved sustainability performance, but only if it translates into a change in behavior [64].

3.6.4. Management

The fourth most frequent theme was Laws & Regulations (5.9%; table 4). Single noncompliance records often listed several illegal issues. In many cases, resolution of legal noncompliances required documentation that demonstrated achievement of, or progress toward, legal compliance. Noncompliances under other themes also often addressed legal issues (e.g. minimum wage in the employment theme) so the power of RSPO certification to drive legal compliance is greater than is represented within this category. Legality has recently been at the forefront of negotiation around palm oil imports [65] and improving legal compliance could have real positive effects on core sustainability issues if regulations align with these key concerns.

Social Impact Assessment, Management, and Monitoring comprised 5.1% of noncompliances, and focused on evidence for existence of plans, as well as ongoing participatory management and monitoring, of social impacts of oil palm development and cultivation (e.g. cultural values, work opportunities).

Meeting such procedural criteria has been shown to support core concerns (e.g. social performance) for Rainforest Alliance certified coffee farms in Brazil [66].

3.6.5. Social

The land rights theme comprised about 4.0% of total noncompliances (table 4). When land rights issues were related to plantation land designations (e.g. oil palm planted within the forest estate, discrepancies between the legal and physical plantation boundary) resolution typically required documentation of attempts to clarify or finalize land tenure with the government. In other cases, noncompliances centered around community rights within the plantation. To address such issues, companies often documented the absence of community claims (e.g. acquiring a government statement that no customary claims exist within the plantation boundary), clarified community rights (e.g. via development of community grazing rights maps), or created and implemented land conflict resolution procedures. While these changes may improve relationships between companies and communities, they are unlikely to affect the ongoing trajectory of industrial oil palm development across community lands given that most certified plantations in this study were developed a decade or more before RSPO certification. Recent econometric analyses of interactions between RSPO certification and communities in Indonesia [7, 62, 67] have similarly found few improvements in social metrics (e.g. poverty, conflict prevalence) near certified plantations.

3.7. Drivers of weak engagement on core sustainability issues

Our findings suggest that third-party RSPO audits rarely directly address core environmental (i.e. deforestation, fire, and peatland drainage) and social (i.e. land conflict) performance issues associated with plantation expansion in the Indonesian oil palm sector. There is evidence that they begin to tackle some international concerns around employment (i.e. minimum wages, underage workers, legally mandated employee benefits), although audits may not address the the full extent of these problems within certified plantations. We cannot confirm whether auditing leads to changes with real benefits for human health. RSPO audits appear to increase grower compliance with Indonesian regulations.

The weak inclusion of several core sustainability concerns is potentially due to interactions between the auditing process and selection bias into certification, standard content and specificity, and the industrial plantation system. Selection bias occurs when companies that choose to become certified are already largely in compliance with the P&C, with only a few relatively minor issues that are addressed during audits [14]. Our finding that mostly older companies are certified indicates that participants are not subject to many criteria related to past land clearing.

In terms of the standard, the 2007 and 2013 P&C do not fully prohibit development of peatlands and forested areas and offer relatively weak protections for human rights. While our results suggest that growers have changed their practices with respect to hiring, wages, and worker benefits, other research indicates that these issues are still severely under-detected [41]. Our qualitative assessment of noncompliance resolution indicates that any changes growers make may simply align them with legal requirements which do not always reflect international standards [68].

Finally, beyond well-known limitations to the auditing process that apply to any third-party certification system, the nature of large-scale oil palm production combined with RSPO procedures increases the risk that auditors miss certain types of noncompliances. All audit-based approaches suffer from a need to sample conditions over a limited time. This is compounded by the RSPO system that allows a company to prepare for the audit and the geographic size and complexity of oil palm plantations, which contrasts with other tropical production systems such as coffee, cacao, or even soybean [14]. In Indonesia, plantations often span thousands of hectares. They may include several divisions planted at different dates across several soil types and topographies, thousands of workers with various origins and duties and contract types, multiple adjacent communities with unique histories of interaction with the company, on-plantation worker housing, a large industrial mill and associated energy and waste facilities, and tied and/or

independent smallholders and other third-party suppliers. Especially for issues where people must trust auditors to divulge sensitive information (e.g. human rights concerns) [11] or which are distributed across vast geographies (e.g. conflicts with communities), time-limited audits may not be able to uncover much meaningful information about corporate performance even when an auditing team is well trained and independent from the company.

3.8. Limitations and future research

Our analysis is limited in several ways. We did not explore the auditing process in other world regions, including interactions with diverse regulatory frameworks. We stopped short of quantitatively analyzing the nature of changes requested of and performed by companies, which would have better linked audits to outcomes. Our approach was unable to identify changes to practices made in preparation for certification but before auditing, thus our results underestimate total change. Spotty data from audit reports, including lack of time to resolution for many non-compliances, limited the completeness of our analysis. Our research could not detect cases where auditors chose not to report or could not detect non-compliances by oil palm companies. Finally, we are unable to examine how substantial changes to the RSPO standard and quality assurance processes since 2015 have affected additionality through auditing.

Given these limitations, we recommend extending this analysis to include audits through 2022 and beyond, and to countries outside of Indonesia. This would provide insight into how standard design and content changes and improved quality assurance affect auditing and how these changes interact [1] with heterogenous governance and socio-environmental contexts across global oil palm growing regions. Alternatives to RSPO certification have arisen due to criticisms about its effectiveness and cost [69, 70]. Thus, comparative research into the monitoring, verification, and enforcement systems for competing supply chain initiatives and certification systems (e.g. Indonesian Sustainable Palm Oil certification; corporate zero-deforestation commitments) would be welcome. Finally, conducting interviews with participants in the certification process—including corporate sustainability officers, auditors, certification body managers, and accreditation bodies—would provide rich qualitative information to contextualize, challenge, and complement our findings.

4. Conclusion

Our research illuminates how monitoring and verification led by auditors contributes to additionality within third party certification systems. While RSPO audits do lead to changes, these adjustments do not

fully address core sustainability issues in the oil palm sector. Low levels of noncompliance detection by some certification bodies likely contribute to this lack of engagement with key issues, although this effect may be moderated or eliminated with improvements in quality assurance as the RSPO certification system matures and evolves. Since the certification bodies in our study typically work across countries and certification systems (e.g. Forest Stewardship Council, RSPO, Marine Stewardship Council) [71], our results may be applicable to other certification systems.

We suggest three improvements to the RSPO certification system. First, auditor findings and grower responses to auditor requests should be made easily available because this information forms the basis for sustainability claims. We recommend that the RSPO track noncompliance detection and resolution—including the loss of certificates due to noncompliance—in a public database. Second, continuing to adapt the training and auditing process to improve the capacity and independence of auditors would provide greater credibility to the RSPO certification system, and may result greater additionality generated from audits [72]. Finally, civil society RSPO members may consider focusing more of their attention on ensuring that the standard that is in place can be effectively monitored, verified, and enforced. Our findings indicate that improving the auditing process—especially for key sustainability concerns in the oil palm sector such as workers' rights—may be enough to generate substantial additionality and increase homogeneity across RSPO certified products without any changes to the RSPO standard.

Data availability statement

The data that support the findings of this study are available upon reasonable request from the authors.

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Author contributions

Kendra Bishop: conceptualization, methodology, investigation, data curation, writing—original draft.

Kimberly M Carlson: conceptualization, investigation, data curation, formal analysis, writing—review and editing, visualization, supervision, project administration, funding acquisition.

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