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RESEARCH ARTICLE

Addressing the challenges of managing and monitoring biodiversity in High Conservation Value areas and High Carbon Stock forests within oil palm landscapes

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Abstract

1. Corporate commitments to biodiversity protection are difficult to achieve due to limited knowledge of effective conservation strategies and insufficient attention to the social challenges involved in fulfilling these commitments. We explore these concerns in tropical oil palm landscapes focusing specifically on the commitment of members of the Roundtable on Sustainable Palm Oil (RSPO) to meeting environmental sustainability standards relating to maintaining or enhancing High Conservation Values (HCVs) and High Carbon Stock (HCS) forests.
2. Prior to developing new plantations, the RSPO requires that baseline assessments are conducted by licensed assessors to identify HCV and HCS forest areas for protection. Growers then develop management actions to mitigate threats to these HCV and HCS forest areas and preserve the conservation values and carbon stocks within them.
3. We investigated the challenges that growers face in achieving these environmental sustainability commitments by carrying out online surveys and interviews of plantation managers (18 participants from 12 oil palm companies in Malaysia and Indonesia). We used findings from our survey and interview questions to make recommendations for improvements in managing and monitoring biodiversity within oil palm landscapes.
4. *Practical implication*. Drawing on findings from our surveys and interviews, integrated with our knowledge of current policy and practice, we make 15 recommendations to help support biodiversity conservation, focused around four themes: (A) *respecting human rights*, including the rights to free, prior and

informed consent (FPIC) and to participation in decision-making processes that affect people's rights; (B) *standardising biodiversity metrics*, with guidance on measuring biodiversity and analysing data on species trends, recognising that local biodiversity is highly dynamic; (C) *building management and monitoring capacity* and buy-in from oil palm companies through training and sharing of best practices; and (D) *improving sustainability processes* by incorporating information into monitoring and adaptive management systems, and creating open, transparent and standardised processes for regular reporting. We hope our recommendations will encourage the implementation of evidence-based practices that respect rights and incorporate local community perspectives, leading to better protection of biodiversity in oil palm landscapes in the long term.

KEYWORDS
biodiversity monitoring, habitat management, High Carbon Stock, High Conservation Values, Roundtable on Sustainable Palm Oil

1 | INTRODUCTION

1.1 | Challenges of managing and monitoring biodiversity in tropical areas

Protecting areas of natural habitat is an approach that is used to help conserve biodiversity in oil palm plantations. Their size (e.g. Lucey et al., 2017) and location (i.e. connectivity; Scriven et al., 2019) affect the biodiversity of these sites and the management of sites is vital for ensuring their natural ecosystems remain in good condition and for maintaining forest canopy cover. Hence, there is a need for sector-specific guidance on the activities that could be carried out by growers, local rights holders and other stakeholders to maintain or enhance biodiversity at their sites. Disentangling the consequences of local management actions from larger-scale anthropogenic and environmental drivers of biodiversity change is also important for implementing successful management actions. These sites, which are often purchased by or leased to companies for development prior to any community engagement, often overlap with the customary lands of Indigenous Peoples and local communities, adding complexity to any potential conservation interventions. Landscape-scale approaches that include all areas that support biodiversity are needed (e.g. including riparian areas and planted areas), and are vital for wide-ranging species, such as the Bornean orangutan (*Pongo pygmaeus*) (Ancrenaz et al., 2021). Hence, there is an increasing focus on jurisdictional approaches and landscape-scale biodiversity measurements, but more understanding and guidance are needed.

Quantifying the 'biodiversity' present at sites is complex because biodiversity comprises many elements, such as species richness and relative abundance, as well as temporal changes. Monitoring methods are well developed in some taxa (e.g. https://ukbms.org/ for butterflies), and the development of 'essential biodiversity variables' (EBVs; Jetz et al., 2019; e.g. https://geobon.org/) provides useful guidance on variables to include. Although this is a dauntingly long list of potential biodiversity measures for industry stakeholders to consider, standardised approaches to biodiversity measurement and evaluation are being developed (e.g. EU ALIGN project; https://capitalscoalition.org/project/align/), and there are online repositories of evidence on the effectiveness of sustainability (https://www.evidensia.eco/) and conservation (https://www.conservationevidence.com/) actions. Nonetheless, there is a lack of specific baseline information on the status of many taxa, and a need for clear, practical guidance on which elements of biodiversity to prioritise, which methods to use and how to analyse data to quantify biodiversity changes. This task is particularly challenging in tropical regions because they contain huge numbers of species, many of which are unnamed, difficult to identify, occur naturally at low densities, or are difficult to monitor (e.g. arboreal rainforest species) (Meijaard & Sheil, 2012). Moreover, many tropical forest sites have been degraded and so would benefit from restoration actions over and above management actions to protect current levels of biodiversity.

1.2 | Protecting biodiversity in oil palm landscapes

The Roundtable on Sustainable Palm Oil (RSPO) is the main voluntary sustainability standards organisation for palm oil globally, covering about 20% of the world's palm oil production (https://rspo.org/). There are concerns about the impacts of palm oil cultivation both on biodiversity (Meijaard et al., 2018) and on human rights (Mei et al., 2022), due to the clearing of forests and drainage of peatlands, as well as the displacement of local peoples during plantation development. The Principles and Criteria of the RSPO Production Standard (see RSPO Principles & Criteria, 2018 #7.12 and RSPO Principles & Criteria, 2024 #7.7) were developed to improve environmental sustainability, of which one aspect is the requirement to identify High Conservation Values (HCVs)

and High Carbon Stock (HCS) forests, and ensure that they are maintained or enhanced (see Appendix S5 for more details of current policy).

There are six classes of HCVs, representing important environmental and social values (Brown et al., 2013; https://www.hcvnetwork.org/; see Table 1 for HCV descriptions). The HCS Approach provides tools for plantation companies and farmers to eliminate deforestation from their operations and includes 14 Social Requirements to ensure respect for Indigenous and community rights. The HCV and HCS approaches can be used together to maximise conservation outcomes for nature and people (HCVN, 2017; Rosoman et al., 2017; Soetjiadi et al., 2023). Prior to new plantings, licensed assessors identify HCV areas and HCS forests, following free, prior and informed consent (FPIC) processes with potentially affected communities. They work with these communities, including through participatory mapping, to identify and locate the social HCVs (values related to ecosystem services, basic necessities, and cultures). This information is then used to inform areas that can or cannot be converted to oil palm. Their assessment reports provide recommendations on how to address environmental threats, not only from the planned land-use conversion but also from other activities, such as poaching/hunting or pollution, so that HCVs and HCS forests are conserved. Reports must incorporate feedback from local communities on initial findings, including on points that are contested and need further data collection or consultation. Reports should also recommend how local community needs could be met following the conversion. Management measures therefore need to protect rare, threatened or endangered species and other ecological and social values (see RSPO Principles & Criteria, 2018 #7.12 and RSPO Principles & Criteria, 2024 #7.7), at the same time ensuring that there are no infringements on community rights. This is often complex as FPIC processes are frequently marked by unequal power relations and conflicting interests between companies and communities (Delabre & Okereke, 2020; Afrizal et al., 2023).

Previous studies have demonstrated the biodiversity benefits of conserving good-quality forest sites within oil palm concessions, for example, for birds (Suwarno et al., 2018), carbon stocks (Fleiss et al., 2020) and connectivity (Meijaard et al., 2020; Scriven et al., 2019). Hence, these sites can support biodiversity, but effective management and monitoring plans are needed to ensure their protection. Companies often rely on consultants or NGOs to translate recommendations from the HCV assessments into their management and monitoring plans. These plans may then be tailored to include particular endangered species that are present (Lyons-White et al., 2017). However, information about rare or threatened species may comprise lists of species presences rather than relative abundances, which are often more sensitive measures of biodiversity change (Meijaard et al., 2020).

In addition to these challenges, management plans based on HCV assessments conducted prior to when the HCV Network established the Assessor Licensing Scheme (ALS) in 2015, which reviews the quality of HCV assessments, will be of variable quality. Companies are required by the RSPO to have a management plan that is implemented and adapted as necessary, but apart from the protection or enhancement of HCVs and rare and threatened species (RSPO Principles & Criteria, 2018 #7.12 and RSPO Principles & Criteria, 2024 #7.7), the standard does not make reference to any other specific biodiversity objectives and targets. Given mounting pressure on the private sector to mitigate their negative social and biodiversity impacts, along with emerging regulation such as the European Sustainable Reporting Standards, companies are increasingly under pressure to demonstrate their performance on

TABLE 1 Definitions for the six High Conservation Value (HCV) categories, taken from the HCV Network (https://www.hcvnetwork.org/library/hcv-definitions).

HCV category	Description
HCV 1	Concentrations of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels
HCV 2	Large landscape-level ecosystems, ecosystem mosaics and Intact Forest Landscapes (IFL) that are significant at global, regional or national levels and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance
HCV 3	Rare, threatened or endangered ecosystems, habitats or refugia
HCV 4	Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes
HCV 5	Sites and resources fundamental for satisfying the basic necessities of local communities or Indigenous Peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or Indigenous Peoples
HCV 6	Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or Indigenous Peoples, identified through engagement with these local communities or Indigenous Peoples

protecting nature and benefitting people. Hence, this is a critical time for improving biodiversity management and monitoring.

We explored the challenges companies face in their biodiversity management and monitoring activities by carrying out online surveys and interviews of plantation managers. We focus on companies in Malaysia and Indonesia where the vast majority of oil palm is grown. We use the information from the surveys and interviews to identify (1) current practices in biodiversity management and monitoring, (2) aspects that are working well and (3) aspects where managers consider improvements are needed. We also draw on findings from several previous studies that have examined this issue (Brown & Senior, 2014; Furumo et al., 2019; Lucey et al., 2023; Lyons-White et al., 2017; Meijaard et al., 2020; Soetjiadi et al., 2023; Watson & Da Costa, 2022) to develop recommendations for better management and monitoring of biodiversity within oil palm landscapes.

2 | MATERIALS AND METHODS

2.1 | Assessing management and monitoring for biodiversity

We developed an online survey (Part 1) and Zoom interview (Part 2) (i.e. a mixed-method survey design), to examine current biodiversity and ecosystem management and monitoring practices by RSPO member oil palm companies (see Appendices S1–S4 for details of the survey and interview). The survey and interview questions were developed following discussions with the RSPO and HCV Network. We restricted our study to companies based in Malaysia and Indonesia because these are the main oil palm producing countries (FAO, 2022), and where we have extensive research expertise (one company also reported on their plantations in Papua New Guinea (PNG) and the Solomon Islands). Surveys and interviews were designed to be completed by 'expert informants', that is, sustainability staff within RSPO certified, or RSPO member (i.e. not yet certified) oil palm companies. Staff roles ranged from Sustainability Managers and Heads of Conservation to Plantation Directors, and the roles varied depending on the size and management structure of the company.

2.2 | Company selection

We invited a total of 40 RSPO member companies to participate in our study, based on the following four criteria according to information on the RSPO website (https://rspo.org/), recent Annual Communication of Progress (ACOP) documents (available on the RSPO website; https://rspo.org/as-an-organisation/membership/acop/) and the Zoological Society of London (ZSL) SPOTT website (https://www.spott.org/):

1. The company is a member of the RSPO and located in Southeast Asia.
2. They are an industrial-sized plantation company (i.e. larger than 50 ha; smallholder farms were not included in our study).
3. They have at least one management unit that is RSPO certified, or due for certification by 2025.
4. They have at least one HCV, HCS forest or other conservation area within their concession.

Our study was carried out between December 2022 and March 2023. We sent an email invitation to members of sustainability staff within each company, which included a project information sheet (Appendix S1) inviting them to participate in our study. These emails were followed up by the RSPO if there was no response. Participants could provide referrals within their company if they felt that another member of staff was better suited to completing our survey and interview questions. Of the 40 companies we contacted, 12 (30%) completed our interviews (which included 18 participants).

The relatively small number of companies included in our study, as well as the probable bias in terms of companies choosing to participate, means that although the quantitative findings we present are likely to represent key themes, they should be interpreted with care as these findings may not represent all RSPO members in Malaysia and Indonesia, or globally. We also recognise that a larger study including interviews with community members as well as companies would likely give a more complete picture of current practices and their strengths and weaknesses.

2.3 | Developing the online survey and interview questions

The short online survey (Appendix S3; completed using 'Qualtrics' software; https://www.qualtrics.com/en-gb/) was available in English, Indonesian (Bahasa Indonesia) and Malay (Bahasa Malaysia). This consisted of a set of 30 questions in which we asked about the participants' role in the company, the size of the team involved in management and monitoring activities across the company, along with some basic concession and conservation area information; for example, whether the company was conducting management and monitoring in their HCV and HCS forest areas and/or other conservation areas on their plantation, and a request to share their management plans with us.

Once the participants had filled in the online survey questions they had the option of conducting the interviews in either English, Indonesian or Malay. The semi-structured Zoom interviews comprised questions on company practices for conserving biodiversity and ecosystem services (Appendix S1). There were 18 questions focused around three main themes: (i) management and monitoring development and implementation, (ii) monitoring interpretation, data analyses and adaptive management, (iii) current barriers to effective management and monitoring, and moving forwards. We sent participants a copy of our interview questions beforehand so that they could prepare their answers if they wished to. While we asked the participants the interview questions in order, a semi-structured approach allowed us to ask follow-up questions. Four interviews

were conducted in English by Sarah Scriven and eight interviews were conducted in Indonesian by Robby Butarbutar. Hence, there were 18 survey respondents and 12 qualitative interviews. No participants opted for interviews in Malay. Zoom interviews took about an hour and were recorded for translation/transcription purposes before being permanently deleted.

2.4 | Data analysis

Data from the surveys were compiled across companies to provide information on factors such as concession and conservation area size, budgets for management and monitoring, and other relevant aspects (Table 2). Each interview transcript was reviewed and the main responses to each question were summarised by Robby Butarbutar and Sarah Scriven. Interviews conducted in Indonesian were translated into English and summarised by Robby Butarbutar, while all interviews conducted in English were summarised by Sarah Scriven. All interview summaries were checked by Sarah Scriven and sent to companies to confirm that their responses had been interpreted correctly. Five companies subsequently made minor changes. Responses were analysed qualitatively, guided by the Framework Approach outlined by Ritchie and Spencer (1994) (also see Lyons-White et al., 2017). We drew upon a priori issues/themes (e.g. those informed by the original research objectives; deductive themes) as well as emergent issues/themes raised by the respondents (inductive themes). We also extracted some quantifiable components from the data where we could identify binary or categorical responses (i.e. 'Yes', 'No', 'Don't know').

3 | RESULTS

3.1 | Current practices in management and monitoring of biodiversity

Responses to our survey questions (Table 2) revealed that nearly all (11/12) companies had designated High Conservation Value (HCV) areas for biodiversity or ecosystem protection (typically HCVs 1–4) within their plantation. These companies used recommendations from their initial baseline surveys from their HCV

TABLE 2 Summary information for the 12 RSPO member companies who took part in the online survey, including the size of their concession and conservation areas, their available budget for management and monitoring activities and other relevant details.

Number of participants	18
Number of companies	12
Countries where answers are most relevant	Indonesia (10 companies), Malaysia (3 companies), PNG & Solomon Island (1 company)
Size of concession areas	~500–600,000+ ha
Size of conservation areas	~115–79,000 ha
Earliest HCV assessments by companies	2007–2022
HCV assessments conducted under the Assessor Licensing Scheme (ALS)	4 companies = 'Yes', 6 companies = 'Some under ALS', 2 companies = 'No'
HCV categories (see Table 1 for details)/HCS forest present	HCV 1 = 10 companies; HCV 2 = 8 companies; HCV 3 = 9 companies; HCV 4 = 11 companies; HCV 5 = 11 companies; HCV 6 = 11 companies; HCS forest = 10 companies
Biodiversity management and monitoring annual budget	Ranging from ~IDR 1–5 billion (~£54–270.5K) for eight companies in Indonesia and ~RM 25–100K (~£4.5–17.5K) for one company in Malaysia. Four companies chose not to answer this question or did not know
Is the budget sufficient?	10 companies = 'Yes', 2 companies = 'No'
Biodiversity management and monitoring team size	4–150 staff
Which fauna are monitored (number of companies that answered yes given in parentheses)	Birds (11 companies), mammals (12 companies), reptiles (8 companies), insects (4 companies), amphibians (4 companies); other taxa included: fish and aquatic biota (1 company)
Which flora are monitored (as listed by companies)	Dicotyledonae, dipterocarp family, *Ficus*, meranti tree: *Shorea* sp., Monocotyledonae, orchids, pancang, Pteridophyta, RTE species (e.g. ulin tree: *Eusideroxylon zwageri*), saplings, seedlings, tiang, trees, trees of customary interest (e.g. sialang tree), vines
Frequency of monitoring	Dependent on taxa; responses included: daily, weekly, monthly, quarterly, every 6 months, annually, every 3 years, opportunistically, no set intervals
Monitoring of rare, threatened and endangered species	10 companies = 'Yes', 2 companies = 'No'
Rare, threatened and endangered species monitored (common names)	Elephant, false gharial, hornbills, jungle cat (kucing hutan), Müller's gibbon, orangutan, otters, pangolin, proboscis monkey, RTE bird species, Siamese crocodile, Storm's stork, sun bear, tarsier, tiger
Have staff received biodiversity training?	11 companies = 'Yes', 1 company = 'No'
Frequency of management plan review	6 months–5 years

assessments carried out under the HCVN's Assessor Licensing Scheme (ALS) to inform their management and monitoring action plans. However, there are challenges in doing this if conservation experts are needed to interpret recommendations and translate them into specific and practical actions. The HCV recommendations are reported to often be very generic, requiring considerable revision and interpretation to adapt them to local conditions. Also, little information was provided on whether and how local communities had contributed to, given feedback on or agreed to these recommendations.

Conservation budgets varied considerably and often influenced how biodiversity priorities were set (Table 2). A range of management and monitoring activities were commonly carried out (Table 3), including regular field patrols to prevent encroachment, illegal logging and poaching, installation of signage, and engagement with local communities to raise awareness of biodiversity policies. Several companies also provided biodiversity training and capacity building for staff, and management and monitoring efforts were typically led by dedicated field staff or rangers, although estate workers and assistant managers sometimes undertook these activities. Two companies relied on auxiliary police for patrols.

Most (9/12) companies reported involving local communities, but involvement is often relatively passive, focusing on consultation, provision of training and participation in operational aspects of implementation. Only three companies mentioned collaboration, cooperation or partnerships. Over half the companies (8/12) reported setting conservation targets or key performance indicators (KPIs) for biodiversity, such as tracking orangutan population sizes or diversity indices of taxa. Other companies focused on more operational goals, such as maintaining the conservation area or adhering to a checklist of required management and monitoring practices. Most (8/12) companies had baseline data for comparison, for example, earlier population estimates or species lists. However, several companies pointed out that rapid HCV assessments often provide an incomplete assessment of local biodiversity and that there is often a disconnect between assessment recommendations and measurable improvements on the ground.

Most companies (10/12) analysed their biodiversity monitoring data to assess changes in population size and species richness, but most companies reported 'no change' in biodiversity or were unsure if there were any changes. Only one company reported a decline, while three noted increases, but some participants noted that trends were site-specific and likely influenced by plantation history, age

TABLE 3 Full list of biodiversity management and monitoring activities reported by 12 RSPO members in our online surveys.

Management activities reported by RSPO members during the current study (*note that different terminology may have been used for the same activity*)	• Boundary demarcation (e.g. installation of stakes at HCV area boundaries) • Collaborations with third/external parties (e.g. for training purposes, species-related projects) • Ecosystem and/or forest restoration • Engagement, capacity building, awareness raising and training with local communities • Engagement, capacity building, awareness raising and training of staff • Engagement, consultation and collaboration with stakeholders • Enrichment planting • Fire mitigation and prevention • Installation of signage/signboards and bulletins • Landscape-level conservation (e.g. retaining patches of forest to act as stepping stones) • Maintaining a tree nursery and distributing plants for restoration purposes • Patrols (e.g. to prevent poaching, encroachment, illegal logging and burning) • Wildlife release and reintroduction programmes
Monitoring activities reported by RSPO members during the current study (*note that different terminology may have been used for the same activity*)	• Camera trapping • Collecting information from workers and communities • eDNA sampling in rivers • Examining drone imagery • Examining satellite imagery • Fauna surveys along a transect (e.g. for birds, orangutans, Lepidoptera) • Fauna surveys using point counts (e.g. for birds) • Fish netting • Flora surveys (e.g. in sampling plots) • Harp trapping (for bats) • Measuring plant phenology • Monitoring forest growth rate in remediation areas • Patrols (e.g. to monitor threats and wildlife) • Pitfall trapping (for small mammals and herpetofauna) • Incidental observations/sightings • Species monitoring through citizen science programmes • Threat monitoring • Weather monitoring • Water quality monitoring • Patrols using the Spatial Monitoring and Reporting Tool (SMART) (ZSL, 2013)

and landscape context, with older plantations generally supporting lower biodiversity.

The most commonly cited threats to biodiversity were forest fires, encroachment, illegal logging, and poaching, and most companies (11/12) adjusted their management practices in response to emerging challenges; for example, engaging more actively with local communities and increasing patrol frequency in response to poaching threats, and tree planting in flood-prone zones. These adaptive responses suggest that many companies are integrating monitoring results into a responsive, learning-based management approach.

3.2 | Aspects of management and monitoring activities that are working well

Many companies considered that their activities contributed to protecting and enhancing biodiversity in the wider landscape beyond their concession boundary, for example by connecting their HCV areas to protected areas nearby (i.e. landscape-scale conservation). The most successful activities included patrolling, engaging with communities and plantation workers, citizen science programmes, a good understanding of conservation practices, engaging with multiple stakeholders and improving forest connectivity. Participants explained why particular activities were effective. Citizen science programmes empower local communities to collect monitoring data, which is more cost-effective than hiring researchers. Some plantation staff take photographs of any species they see, which they upload to a WhatsApp group for identification. Hiring rangers for patrolling is also cost-effective, given that they can also warn of forest fires.

Nearly all companies (11/12) collaborated in some way with biodiversity experts from external organisations when designing and implementing their management and monitoring activities (e.g. with NGOs, government agencies, universities; Table 4). These collaborations were often seen as achieving positive conservation outcomes and supporting the design of better management plans for biodiversity, including those that integrate the goals of multiple parties (e.g. from provincial to village-level governments, affected communities to NGOs and companies).

3.3 | Aspects of management and monitoring that need improving

Management and monitoring challenges were primarily technical (e.g. insufficient staff expertise), social (e.g. human-wildlife conflicts) and collaborative (e.g. lack of government support) as opposed to economic (e.g. inadequate allocation of resources). Technical challenges

TABLE 4 Summary of findings from our Zoom interviews with 12 RSPO members.

Objective 1 Development and implementation	• The most severe threats to biodiversity are from fire, encroachment, poaching and illegal logging • All companies carried out activities to enhance biodiversity, and most companies (11/12) found the recommendations in HCV assessments helpful in informing their activities • Most companies (8/12) had specific targets or KPIs for their conservation strategies, although these varied considerably • Most companies (9/12) used standardised survey methods for their monitoring, and most companies (10/12) analysed their monitoring data in some way • Only three companies reported increasing biodiversity, and one company reported decreasing biodiversity, with most companies (8/12) reporting 'no change', 'it depends' and/or 'I don't know' • There was large variation among companies in annual budgets for management and monitoring, which were prioritised in different ways • Most companies (11/12) used adaptive management practices
Objective 2 Successes	• Most companies (8/12) reported that their activities contributed to protecting/enhancing biodiversity in the wider landscape • Successful activities for achieving positive conservation outcomes included patrolling, engaging with multiple stakeholders (including local communities and plantation workers) and improving forest connectivity • Nearly all companies (11/12) consulted with or collaborated with external organisations or institutions, which some companies saw as having positive conservation outcomes
Objective 3 Challenges	• Social challenges included human-wildlife conflicts, a lack of clarity on participatory mapping in HCV assessments, and dealing with threats from encroachment, fires and illegal logging • Technical challenges included staff lacking expertise in management and monitoring protocols, data collection, analysis and interpretation of results, species identification and knowledge of biodiversity conservation • Many companies (7/12) wanted more training relating to these technical challenges • Economic challenges included convincing senior management of the value of biodiversity conservation, lack of staff and lack of funds for expensive new technologies • Collaborative challenges included a lack of government support and difficulties in engaging multiple stakeholders for landscape-scale conservation and management

Note: Findings are presented in relation to our three main objectives: (1) improve our understanding of how biodiversity management and monitoring plans are developed and implemented; (2) determine which activities companies believe are working well; (3) determine which activities companies would most like to improve to enhance biodiversity. Findings are based on responses of RSPO members to our interview questions, and we did not require any evidence to be provided in support of responses provided.

were reported by most companies (10/12), with staff lacking skills and expertise in biodiversity management and monitoring protocols, data analysis, species identification and knowledge of biodiversity conservation. Companies would like more guidance and training for field staff and there is a lack of easy-to-understand guidance in HCV assessments. There is also a need for methodologies that can be easily translated into actionable practices and recommendations on biodiversity monitoring indicators for determining whether conservation activities are having a positive impact. Companies would like more guidance on best practices for enhancing and restoring degraded HCV areas, and how to manage many fragmented HCV areas scattered across the plantation landscape.

All companies reported social challenges, including illegal logging, forest fires, encroachment and poaching and that these threats were more of an issue in smaller HCV areas close to local communities. In some cases, HCV participatory mapping has not provided sufficient clarity for companies on what is required, particularly with respect to land tenure and the delineation of HCV area boundaries. This lack of clarity can create risks of conversion if boundaries are disputed or inaccurate. While participatory mapping can highlight community use and values, decisions about how communities should be involved in ongoing management and monitoring typically need to be addressed through subsequent negotiation, beyond the mapping process itself. Participants expressed the opinion that successful biodiversity initiatives require communities to be involved, and if communities are financially secure, they can focus on biodiversity conservation.

Some participants reported economic challenges from difficulties in convincing senior management of the value of biodiversity conservation. Putting a financial value on biodiversity might convince senior management to provide additional resources. Only half of companies (6/12) had sufficient staff to carry out management and monitoring activities, and it was considered highly beneficial to have a dedicated team. Some companies are using new technologies, including remote sensing technologies (e.g. the use of satellite data, hotspot monitoring and drones) to monitor forests, although these technologies are not affordable for many growers. The RSPO could commission the development of a platform to offer access to innovative technologies for members to utilise.

In terms of collaborative challenges, several Indonesian companies reported a lack of support from their government, and expressed a hope that their government would take a more active role in relation to HCV assessments and biodiversity conservation. Several participants highlighted the importance of HCV area connectivity and landscape-scale conservation beyond their plantation boundaries, which requires multi-stakeholder collaborations to be effective. More encouragement and support to be part of landscape-scale conservation actions is required, for example via multi-stakeholder management forums, including provincial to village-level governments, local communities, NGOs, as well as oil palm companies and the development of landscape-scale biodiversity action plans. See Scriven et al. (2025) for supporting data from the anonymised survey and interview responses.

4 | DISCUSSION

4.1 | Recommendations for improving biodiversity in oil palm landscapes

We synthesise the findings from our surveys and interviews, together with our knowledge of current biodiversity policy and practice in Southeast Asia and insights from previous studies, to draw up 15 recommendations for improving biodiversity management and monitoring in oil palm landscapes. We have grouped our recommendations around four main themes: (A) respecting human rights; (B) standardising biodiversity metrics; (C) building management and monitoring capacity; and (D) improving sustainability processes. It is important to point out that while it is useful to identify specific recommendations, we think progress on managing and monitoring biodiversity will be best made by considering the recommendations together given that most of them are interlinked.

4.1.1 | Respecting human rights

R.1. Respect the right of affected communities to give or withhold consent

Through the FPIC process, Indigenous Peoples and many other communities have the right to give or withhold consent to the creation of conservation areas on lands where they have customary rights, as well as to proposed management and monitoring activities for these areas and to any subsequent changes in these activities. This means that in addition to the initial FPIC process, communities need to be consulted about any proposed changes in management and have the right to participate in management and monitoring (see appendix 3 of RSPO Principles & Criteria, 2018). Participation may be at a strategic level or simply in operational aspects such as patrolling, habitat restoration activities, or monitoring. Alternatively, communities may prefer for the company to carry out all activities according to agreed terms. The vital point in terms of respect for rights is that they are free to decide what level of participation they desire. However, power imbalances between them and companies are a potential barrier to ensuring respect for these rights.

R.2. Agree management measures jointly

The management and monitoring plans for conservation areas on lands where communities have demonstrable legal, customary and/or user rights must be developed through inclusive dialogue with these communities, including voices of more marginalised groups. Companies need to seek community engagement to co-develop measures, and respect the rights of communities to give or withhold consent for certain measures, and propose alternatives based on local needs and Indigenous knowledge. Once the species or other features to be prioritised for conservation have been agreed, best practice is that communities and external actors work together to come up with strategies to best protect and conserve them, building

on Indigenous knowledge and practices. It is well established that equitable partnerships with Indigenous Peoples and local communities bring more positive ecological (and social) outcomes compared to less active forms of participation (e.g. Dawson et al., 2024; Santika et al., 2019).

R.3. Negotiate solutions where there are conflicts between social and environmental HCVs

Where there is a potential conflict between management measures for ecological HCVs (HCVs 1–4), and those for social HCVs (HCVs 5-6; see Table S1), or where environmental impacts may be caused by community activities, this should be discussed openly as part of the initial FPIC process. Prior to finalisation of operational plans, a formal, mutually agreed grievance procedure should be in place that is culturally appropriate. Where there is a genuine conflict of interest, a negotiated solution should be sought that is clearly defined and mutually agreed upon, based on full respect for local people's rights and national laws, and where necessary, includes a clearly defined benefits package in return for any community restrictions. Communities need to be facilitated to bring their case to the RSPO's complaint panel if conflict cannot be resolved between involved parties directly. This option to bring grievances to the RSPO complaint panel needs to be communicated at the start of the FPIC process (RSPO FPIC guide, 2022).

R.4. Create spaces for meaningful ongoing engagement

Conservation measures are most likely to be effective, and conflicts likely kept to a minimum, if communities continue to be involved in management decisions on an ongoing basis. A common practice is for companies to provide information to community representatives at annual stakeholder meetings and invite questions from the stakeholders, but this alone is unlikely to be sufficient to maintain community engagement. Rather, companies need to invest in maintaining good relations with different groups within communities, providing spaces for their equitable participation on an ongoing basis through institutions or representatives of their own choosing. The success in maintaining these good relationships also needs monitoring.

4.1.2 | Standardising biodiversity metrics

R.5. Design protocols for long-term monitoring

Information used to identify HCVs for protection provides useful evidence for determining the biodiversity value of an area, including species presence/absence at sites, and threats (such as from poaching, pollution and invasive species). However, the biodiversity metrics for measuring long-term changes usually require information on species abundance trends. Therefore, initial HCV assessments can provide a general starting point for developing baselines for assessing change, but more detailed guidance is required for designing standardised and long-term monitoring programmes that can inform adaptive management actions. Aligning monitoring with standards being developed for emerging biodiversity credit markets is likely to help in the standardisation and rigour of monitoring programmes, although it is currently unclear if these emerging markets will deliver successfully for biodiversity.

R.6. Identify indicator taxa

Areas with high species diversity are usually identified for protection according to the presence of specific rare, threatened or endangered species listed in the initial HCV assessment (e.g. Bornean orangutan, *Pongo pygmaeus*). Management generally focuses on maintaining these species but there is also a need to include a broader range of the components of local biodiversity. It is important to identify taxa/species (which might include birds and butterflies) that are sensitive indicators of biodiversity change for the full suite of priority species, habitats, ecosystem services and tropical regions (i.e. HCVs 1–4, see Table 1). Indicator groups need to be sensitive to management actions, reflect the responses of a wider range of priority species, be straightforward to monitor reliably and inform adaptive management plans.

R.7. Determine ecological conditions

Good ecological conditions are essential for supporting biodiversity and ecosystem services within Southeast Asian rainforests, for which forest structure and canopy cover are good indicators. Remote sensing approaches are rapidly evolving to become more viable and accessible for providing measures of canopy density (e.g. see https://gedi.umd.edu/), which can be complemented with local field surveys (e.g. Forest Integrity Assessment tool: HCVN, 2021; Suggitt et al., 2021) to monitor local changes in forest condition. In freshwater systems, ecological characteristics such as biological oxygen demand are also important.

R.8. Recognise natural dynamism of social-ecological systems

Biodiversity may change naturally over time and space due to the inherent dynamism of social-ecological systems. Deliberate or accidental damage to conservation areas, factors in the wider landscape, as well as climate change, will affect the species present at sites (including invasive and non-native species). Natural changes to species and habitats, or short-term changes due to sustainable customary use (including traditional shifting cultivation), or changes beyond the control of the company (such as changes in the wider landscape), need to be recognised during the interpretation of monitoring data and reported in a transparent way. This natural dynamism of social-ecological systems requires adaptive management practices and the development of standardised but flexible guidance. The inherent variability of tropical forest biodiversity will lead to some uncertainty in understanding drivers of change and hence the effectiveness of management actions, and more understanding is needed about how to address this. More information is also needed about biodiversity in multi-use landscapes, which may in turn affect these dynamic changes.

R.9. Monitor external threats

Monitoring of external threats such as land-use change in the wider landscape, fire, or pollution is important. This information will help managers understand the potential causes of biodiversity changes

at sites, the success (or not) of local management actions and inform adaptive management plans. Standardised guidance to monitor and assess these external threats needs to be developed, which could include community-led monitoring (for practical guidance, see Brittain et al., 2024), or tools such as the Spatial Monitoring and Reporting Tool (SMART) (https://smartconservationtools.org/en-us/). Existing technology that is currently used to provide deforestation alerts (e.g. NASA OPERA programme; https://www.jpl.nasa.gov/go/opera) may in future also be able to attribute changes to threats, such as fire.

4.1.3 | Building management and monitoring capacity

R.10. Improving in-house capacity

Better awareness and stronger commitments by companies are needed to ensure that dedicated financial and human resources are focused on biodiversity management and monitoring activities. Training and capacity-building of conservation staff in effective monitoring is required. Staff need training to help them make evidence-based decisions that respect human rights, to design effective monitoring programmes, to carry out data analysis and interpretation and to develop skills in using new technologies (e.g. using LiDAR data, eDNA and bioacoustics). Allowing staff to be involved in the collection and analysis of data and see where their actions are being effective, and monitoring species/taxa they are strongly invested in, is likely to motivate staff and generate strong buy-in (Maharani et al., 2025). Improved training and capacity building of auditors is also needed, including enhanced training on HCV assessments and adaptive management and ongoing training to keep up to date with current practices and disseminate best practice.

R.11. Employee and community-based monitoring

Engaging plantation staff and local community members through 'community science' activities will help in the collection of biodiversity data (Maharani et al., 2025). This approach helps address the challenges of collecting sufficient high-quality data on spatial and temporal variations in species abundance (often limited due to lack of resources), and in motivating companies and their staff to participate consistently over long periods. Engaging employees and community members fosters a sense of pride and ownership, which can enhance participation in monitoring and the amount of data obtained, as well as building understanding and respect for biodiversity. For example, an employee-based monitoring project in seven Indonesian oil palm estates collected 148,286 species observations in 5 years, providing valuable biodiversity insights at a cost of only USD 0.12 per hectare per year (Maharani et al., 2025).

R.12. Identifying best-practice and exchanging knowledge

Facilitating the sharing of best practices among RSPO members for biodiversity management and monitoring is needed (e.g. via an online platform and toolkit), so that managers can identify the most appropriate actions that will generate successful biodiversity outcomes. In this way, implementing actions that are known to be ineffective can be avoided, and knowledge gaps can be identified where new research is urgently needed. Promoting ways to facilitate knowledge exchange among RSPO members, and with researchers and NGOs, and supporting communities of best practice, will aid the sharing of successful case studies and evidence-based management (e.g. on forest restoration methods).

4.1.4 | Improving sustainability processes

R.13. Setting biodiversity baselines

It is important that recommendations from the initial HCV assessments are translated into actionable practices for ongoing biodiversity management. This requires improving the interactions between the licensed assessors who carry out the initial assessments, and the plantation managers who subsequently develop their management and monitoring plans based on these assessments. The initial assessments typically provide baseline data on the presence of species and habitats, but additional biodiversity metrics need to be defined that are sensitive to assessing biodiversity change (see Section 4.1.2), which feed into adaptive management plans that are regularly reviewed and updated.

R.14. Landscape-scale conservation

There is an increasing focus on landscape-scale and jurisdictional approaches that involve pilot projects trialling landscape-scale biodiversity measurements, but more guidance is needed on how to measure diversity at these larger spatial scales and effective management actions to enhance biodiversity at a landscape scale. Promoting the use of the High Conservation Value Network (HCVN) Screening Guide (Watson, 2020), which provides guidance for identifying and prioritising action for HCVs in jurisdictional and landscape settings, will help to ensure biodiversity protection at a landscape scale. More explicit guidance and support is needed to ensure respect for the rights of Indigenous Peoples and local communities, and for building multi-stakeholder communities (e.g. involving local government, NGOs, local communities, oil palm companies) to facilitate effective landscape-scale conservation.

R.15. Transparency and standardisation

Providing open, transparent and standardised processes for regular reporting on management and monitoring is required. This includes standardised templates for reporting management and monitoring plans that can be used as a starting point for negotiations with Indigenous Peoples and local communities at each site. More transparency will support companies in their commitments to biodiversity, and help assure consumers of the effectiveness of sustainability practices.

4.2 | Concluding comments and next steps

The recommendations from our study are in broad agreement with previous studies (Furumo et al., 2019; Lyons-White et al., 2017;

Meijaard et al., 2020) that have highlighted the challenges of effective conservation and protection of biodiversity in oil palm landscapes. General guidance is available for HCV management and monitoring (Brown & Senior, 2014), however, oil palm plantation managers would benefit from guidance that is more specific to their context and that recognises regional variation in biodiversity and its response to management actions. We hope our recommendations will inspire new actions, and encourage the RSPO to work with relevant stakeholders, including local communities, environmental consultants, the ALS, NGOs, research collaborators and growers to make progress in identifying solutions. The RSPO should also take a role in facilitating progress on these recommendations. Actions are needed to strengthen requirements of sustainability standards, enhance auditor capacity and independence, and develop more explicit guidelines and practices for engaging with Indigenous Peoples and local communities. These actions will contribute to the prioritisation and co-design of new, improved biodiversity practices and processes in a supportive and collaborative environment that is socially fair. In a world concerned about the global biodiversity crisis, it is vital to develop robust processes and practices to ensure the sustainable cultivation of oil palm, for the benefit of nature and people.

AUTHOR CONTRIBUTIONS

Glen Reynolds, Jennifer Lucey, Sarah Scriven and Jane Hill obtained funding for the SEnSOR (Socially and Environmentally Sustainable Oil Palm Research) Project (https://www.sensorproject.net/). Sarah Scriven, Robby Butarbutar, Jennifer Lucey, Rosanne de Vos and Jane Hill conceived the ideas and designed the research. Sarah Scriven and Robby Butarbutar carried out the research, collected and analysed the data (with input from Rosanne de Vos) and produced the first draft of the SEnSOR report for the RSPO upon which this paper is based. All authors contributed critically to the drafting, writing and revision of the paper, and approved the final version for publication.

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CONFLICT OF INTEREST STATEMENT

Erik Meijaard has conducted paid assignments for oil palm companies and the RSPO. Jen Lucey, Sarah Scriven and Glen Reynolds have previously received funding from an RSPO member company included in the surveys to conduct research on a separate project. Robby Butarbutar was also previously employed by one RSPO member company included in the survey. The South East Asia Rainforest Research Partnership (SEARRP) is a member of the HCVN and holds observer status on the RSPO's Biodiversity and High Conservation Values Working Group.

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/2688-8319.70162.

DATA AVAILABILITY STATEMENT

Anonymised responses from our surveys and interviews are available from the Dryad Digital Repository https://doi.org/10.5061/dryad.qjq2bvqvj (Scriven et al., 2025), following agreed processes from the University of York's Biology Ethics Committee (BEC) for sharing personal data.

ETHICAL APPROVAL

The study received ethical approval from the University of York's BEC. In the Supporting Information, we include the information sheets and consent forms sent to participants. All interviews were voluntary and participants signed consent forms before being interviewed; participants could leave the study at any point.

STATEMENT ON INCLUSION

This was a desk-based study conducted in the UK; however, we conducted interviews with oil palm sustainability managers across Indonesia and Malaysia to gather insights into their management and monitoring practices for biodiversity conservation. The majority of our participants were from Southeast Asia, and we offered them the option to conduct interviews in English, Indonesian (Bahasa Indonesia) or Malay (Bahasa Malaysia), ensuring that language barriers did not limit their intellectual contributions. These sustainability managers provided key insights into the practical challenges and local perspectives on biodiversity conservation in RSPO plantations across Malaysia and Indonesia. Two of our co-authors (Robby Butarbutar and Felicia Lasmana) are also Indonesian, and they contributed valuable intellectual input based on their extensive experience in conservation biology in Southeast Asia. Their expertise significantly shaped the development of this paper and our recommendations for improving biodiversity in oil palm landscapes moving forward.

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REFERENCES

Afrizal, A., Hospes, O., Berenschot, W., Dhiaulhaq, A., Adriana, R., & Poetry, E. (2023). Unequal access to justice: An evaluation of RSPO's capacity to resolve palm oil conflicts in Indonesia. *Agriculture and Human Values*, *40*(1), 291–304. https://doi.org/10.1007/s10460-022-10360-z

Ancrenaz, M., Oram, F., Nardiyono, Silmi, M., Jopony, M. E. M., Voigt, M., Seaman, D. J. I., Sherman, J., Lackman, I., Traeholt, C., Wich, S., Santika, T., Struebig, M. J., & Meijaard, E. (2021). Importance of orangutans in small fragments for maintaining metapopulation dynamics. *Frontiers in Forests and Global Change*, *4*, 560944. https://doi.org/10.3389/ffgc.2021.560944

Brittain, S., Newing, H., de Fátima Cornejo Cardich, A., Farhan Ferrari, M., Gómez Fernández, N. Y., Huamancayo Quiquín, B., Kenrick, J., Kibelio, F., Kitelo, P., Kitelo, E., López Cruz, M., Ndiema, P., Mera Mejía, A. P., del Pérez Ojeda Arco, M., Rowley, T., & Milner Gulland, E. J. (2024). *Introduction to community-based environmental monitoring: Practical guidance for monitoring of natural resources by Indigenous Peoples and local communities*. Forest Peoples Programme (FPP). https://transformativepathways.net/introduction-to-community-based-environmental-monitoring-practical-guidance-for-monitoring-of-natural-resources-by-indigenous-peoples-and-local-communities/

Brown, E., Dudley, N., Lindhe, A., Muhtaman, D. R., Stewart, C., & Synnott, T. (Eds.). (2013). *Common guidance for the identification of high conservation values*. HCV Resource Network. https://global-uploads.webflow.com/624493bb51507d22cf218d50/6286878c1de2255dee34ecfc_HCVCommonGuide_English-07-17-web.pdf

Brown, E., & Senior, M. J. M. (2014). *Common guidance for the management and monitoring of high conservation values*. HCV Resource Network. https://global-uploads.webflow.com/624493bb51507d22cf218d50/6286866d8bbf4719b4e1d5af_HCV_Mgmt_Monitoring_final_english.pdf

Dawson, N. M., Coolsaet, B., Bhardwaj, A., Booker, F., Brown, D., Lliso, B., Loos, J., Martin, A., Malena, O., Pascual, U., Sherpa, P., & Worsdell, T. (2024). Is it just conservation? A typology of indigenous peoples' and local communities' roles in conserving biodiversity. *One Earth*, *7*(6), 1007–1021. https://doi.org/10.1016/j.oneear.2024.05.001

Delabre, I., & Okereke, C. (2020). Palm oil, power, and participation: The political ecology of social impact assessment. *Environment and Planning E: Nature and Space*, *3*(3), 642–662. https://doi.org/10.1177/2514848619882013

FAO. (2022). *Agricultural production statistics. 2000–2020*. FAOSTAT Analytical Brief Series No. 41. https://www.fao.org/3/cb9180en/cb9180en.pdf

Fleiss, S., Waddell, E. H., Ola, B. B., Banin, L. F., Benedick, S., Sailim, A. B., Chapman, D. S., Jelling, A., King, H., McClean, C. J., Yeong, K. L., & Hill, J. K. (2020). Conservation set-asides improve carbon storage and support associated plant diversity in certified sustainable oil palm plantations. *Biological Conservation*, *248*, 108631. https://doi.org/10.1016/j.biocon.2020.108631

Furumo, P. R., Barrera-Gonzalez, E. I., Espinosa, J. C., Gómez-Zuluaga, G. A., & Aide, T. M. (2019). Improve long-term biodiversity management and monitoring on certified oil palm plantations in Colombia by centralizing efforts at the sector level. *Frontiers in Forests and Global Change*, *2*(56), 46. https://doi.org/10.3389/ffgc.2019.00046

HCVN. (2017). *HCV-HCSA assessment manual*. https://highcarbonstock.org/wp-content/uploads/2022/11/HCV_HCSA_Assessment-Manual_Eng.pdf

HCVN. (2021). *Forest Integrity Assessment. A simple and user-friendly tool for assessing and monitoring biodiversity conditions in forests and forest remnants*. https://www.hcvnetwork.org/library/forest-integrity-assessment-tool-fiat-manual

Jetz, W., McGeoch, M. A., Guralnick, R., Ferrier, S., Beck, J., Costello, M. J., Fernandez, M., Geller, G. N., Keil, P., Merow, C., Meyer, C., Muller-Karger, F. E., Pereira, H. M., Regan, E. C., Schmeller, D. S., & Turak, E. (2019). Essential biodiversity variables for mapping and monitoring species populations. *Nature Ecology & Evolution*, *3*(4), 539–551. https://doi.org/10.1038/s41559-019-0826-1

Lucey, J. M., Palmer, G., Yeong, K. L., Edwards, D. P., Senior, M. J., Scriven, S. A., Reynolds, G., & Hill, J. K. (2017). Reframing the evidence base for policy-relevance to increase impact: A case study on forest fragmentation in the oil palm sector. *Journal of Applied Ecology*, *54*(3), 731–736. https://doi.org/10.1111/1365-2664.12845

Lucey, J. M., Scriven, S. A., Hector, A., Reynolds, G., & Tri Prasetia, B. (2023). *Recommendations to the RSPO for monitoring of biodiversity in HCVs*. http://www.sensorproject.net/wp-content/uploads/2017/09/SEnSOR-HCV-Project-Two-Page-Report-FINAL.pdf

Lyons-White, J., Villalpando, P., Zrust, M., Khairina, G., Colchester, M., Luckyharto, D., Anderson, P., Lawrence, L., Delabre, I., Brown, E., & Senior, M. (2017). *HCV management & monitoring. A review of field-level barriers to effective HCV management and monitoring in RSPO-certified oil palm plantations*. HCV Network Ltd. https://www.hcvnetwork.org/posts/study-hcv-management-monitoring-in-rspo-certified-plantations

Maharani, N., Nardiyono, Munthe, C. R., Swayanuar, P., Ni'Matullah, S., Sueif, S., Zaini, S., Supriatna, J., Kusrini, M., Dennis, R., van Balen, B., van Strien, A., & Meijaard, E. (2025). A novel citizen science-based wildlife monitoring and management tool for oil palm plantations. *bioRxiv*. https://doi.org/10.1101/2025.01.12.632638

Mei, L., Newing, H., Almas Smith, O., Colchester, M., & McInnes, A. (2022). *Identifying the human rights impacts of palm oil: Guidance for financial institutions and downstream companies*. Forest Peoples Programme. https://www.forestpeoples.org/en/report/07-2022/human-rights-impacts-palm-oil-guidance

Meijaard, E., Ancrenaz, M., & Balen, B. (2020). *Biodiversity impact of RSPO certification—An assessment of good practices*. A Report by Borneo Futures for RSPO. https://rspo.org/wp-content/uploads/biodiversity-impact-of-rspo-certification-an-assessment-of-good-practices-2021.pdf

Meijaard, E., Garcia-Ulloa, J., Sheil, D., Wich, S. A., Carlson, K. M., Juffe-Bignoli, D., & Brooks, T. M. (2018). *Oil palm and biodiversity*. A situation analysis by the IUCN Oil Palm Task Force. https://portals.iucn.org/library/sites/library/files/documents/2018-027-En.pdf

Meijaard, E., & Sheil, D. (2012). The dilemma of green business in tropical forests: How to protect what it cannot identify. *Conservation Letters*, *5*(5), 342–348. https://doi.org/10.1111/j.1755-263X.2012.00252.x

Ritchie, J., & Spencer, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman & R. E. Burgess (Eds.), *Analyzing qualitative data* (pp. 173–194). Routledge.

Rosoman, G., Sheun, S. S., Opal, C., Anderson, P., & Trapshah, R. (2017). *The HCS approach toolkit*. HCS Steering Group. https://highcarbonstock.org/toolkit/

RSPO. (2018). *RSPO Principles and Criteria for the production of sustainable palm oil*. https://rspo.org/principles-and-criteria-review

RSPO. (2022). *RSPO Free, Prior and Informed Consent (FPIC) guide*. https://rspo.org/wp-content/uploads/RSPO-Free-Prior-and-Informed-Consent-FPIC-Guide-2022_RSPO-GUI-T08-002-V2-ENG.pdf

RSPO. (2024). *RSPO Principles and Criteria for sustainable cultivation of oil palms & production of sustainable palm oil and oil palm products: Version. 4-0*. https://rspo.org/resources/?category=final-draft&id=50902

Santika, T., Wilson, K. A., Budiharta, S., Kusworo, A., Meijaard, E., Law, E. A., Friedman, R., Hutabarat, J. A., Indrawan, T. P., St. John, F. A. V., & Struebig, M. J. (2019). Heterogeneous impacts of community forestry on forest conservation and poverty alleviation: Evidence from Indonesia. *People and Nature*, *1*(2), 204–219. https://doi.org/10.1002/pan3.25

Scriven, S. A., Butarbutar, R. B., de Vos, R. E., Lucey, J. M., Reynolds, G., Newing, H., Scholtz, O., Lasmana, F. P. S., Meijaard, E., & Hill,

J. K. (2025). Data from: Addressing the challenges of managing and monitoring biodiversity in High Conservation Value areas and High Carbon Stock forests within oil palm landscapes. *Dryad Digital Repository*. https://doi.org/10.5061/dryad.qjq2bvqvj

Scriven, S. A., Carlson, K. M., Hodgson, J. A., McClean, C. J., Heilmayr, R., Lucey, J. M., & Hill, J. K. (2019). Testing the benefits of conservation set-asides for improved habitat connectivity in tropical agricultural landscapes. *Journal of Applied Ecology*, *56*(10), 2274–2285. https://doi.org/10.1111/1365-2664.13472

Soetjiadi, A., Silva, R., Frojan, J., Lasmana, F., Dewanto, H., Aldina, R., & Wulffraat, R. (2023). *HCV-HCSA assessment manual*. HCV Network Ltd. https://www.hcvnetwork.org/library/hcv-hcsa-assessment-manual-english-2023

Suggitt, A. J., Yeong, K. L., Lindhe, A., Agama, A., Hamer, K. C., Reynolds, G., Hill, J. K., & Lucey, J. M. (2021). Testing the effectiveness of the forest integrity assessment: A field-based tool for estimating the condition of tropical forest. *Ecological Solutions and Evidence*, *2*, e12067. https://doi.org/10.1002/2688-8319.12067

Suwarno, A., van der Meer, P. J., Beaujon, N., Kok Loong, Y., Arifin, Y. F., Rachmanadi, D., Hill, J. K., Reynolds, G., & Lucey, J. M. (2018). *Testing the impact of RSPO HCV areas in retaining biodiversity and carbon stocks in the oil palm landscape: Initial results from the first phase of field sampling*. http://www.sensorproject.net/wp-content/uploads/2018/03/SEnSOR-HCV-fieldwork-phase-two-technical-report-FINAL_lowres.pdf

Watson, E. (2020). *High Conservation Value (HCV) screening: Guidance for identifying and prioritising action for HCVs in jurisdictional and landscape settings*. HCV Network Ltd. https://www.hcvnetwork.org/library/hcv-screening-guide

Watson, E., & Da Costa, V. F. (2022). HCV Network Discussion Paper. Adaptive management: Protecting HCVs in the long-term. HCV Network. https://global-uploads.webflow.com/624493bb51507d-22cf218d50/63356f2df13567caeff00d51_220912%20-%20HCV%20-%20Discussion%20Paper%20-%20Low.pdf

ZSL. (2013). *A practical toolkit for indentifying and monitoring biodiversity in oil palm landscapes*. https://global-uploads.webflow.com/624493bb51507d22cf218d50/6480bdc7a88e3bfddf628da5_ZSL_Practical_toolkit_oil_palm.pdf

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1: The participant information sheet (English version) sent to RSPO members to invite them to participate in our study.

Appendix S2: The consent form (English version) sent to all RSPO members to sign before participating in our study.

Appendix S3: Survey questions provided to participants before the qualitative interviews (administered via Qualtrics).

Appendix S4: The interview questions for RSPO members on their biodiversity management and monitoring (M&M) practices.

Appendix S5: Summary of the RSPO Principles and Criteria (P&C) for biodiversity conservation (from 2007 to 2024) with information on current biodiversity management and monitoring practices in oil palm landscapes in relation to High Conservation Values (HCVs) and High Carbon Stock (HCS) forest areas.

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