



Confronting the palm oil crisis: Identifying behaviours for targeted interventions

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ABSTRACT

Palm oil is an edible oil with a high yield, various economic benefits, and many diverse uses. However, its production has led to increased deforestation, the endangerment of several species, and toxic greenhouse gas emissions. The current study had two aims: (1) to generate a list of palm oil-related pro-environmental behaviours (PEB) that general community members in Australia can do; and (2) to identify one or more behaviours from this list to address in a behaviour-change intervention. Semi-structured interviews with 12 experts (environmental journalists, conservation scientists and activists) generated a list of 11 potential palm oil-related PEB. The same experts rated this list in terms of potential effectiveness in reducing the negative environmental effects of palm oil. A community sample of 300 participants rated the same PEB on likelihood of adoption and current penetration (i.e., the extent to which they already engage in the behaviour). These scores were integrated into a behaviour prioritization matrix, which revealed that the most beneficial PEB to target was “purchasing products containing only sustainable palm oil”. This study is an essential preliminary step in behaviour change interventional research, and outlines the process of selecting specific consumer behaviour related to environmental concerns. Policy-based implications are discussed.

1. Introduction

In an era of increased consumerism and global wealth, wide-spread urbanization and changing lifestyles have resulted in a growing demand for edible oil, often used in packaged and processed foods (Meijaard et al., 2018). Palm oil, derived from *elaeis guineensis*, has gained popularity due to its versatility, high yield, and relatively low production cost (Meijaard et al., 2018). Originally found in West Africa, the oil palm crop flourishes in tropical regions. Currently, Indonesia and Malaysia are the world's largest producers. In 2017–2018, Indonesia was estimated to produce 36.5 million metric tonnes of palm oil (Wright and Rahmanulloh, 2017), and this number is projected to reach 60 million tonnes annually by 2020 (World Growth, 2011).

1.1. The palm oil industry and its impacts

The rapid growth in the palm oil industry offered opportunities for livelihood in these producing developing countries and is a major source of income for rural communities (Lee et al., 2013). Approximately 40 per cent of palm oil produced in Indonesia is obtained from smallholder farms, which are run as family farms (Meijaard et al., 2018). However, the expansion of oil palm plantations into tropical

forests in Southeast Asia has been associated with environmental concerns and social conflicts (Koh and Wilcove, 2009; Meijaard and Sheil, 2013; Sheil et al., 2009).

Between 1990 and 2015, almost 25 per cent of Indonesia's rainforests were destroyed (World Bank, 2018), a large proportion of which is attributed to oil palm farming (Gilbert, 2012; Koh and Wilcove, 2008). Fig. 1 shows the extent of deforestation from 1973 to 2016 in the island of Borneo (Gaveau, 2017). This deforestation has negatively impacted the biodiversity in Southeast Asia (Koh and Wilcove, 2008), and has led to the critical endangerment of several native species, including the orangutan, Sumatran tiger, pygmy elephant, and sun bear (Meijaard and Sheil, 2013). The orangutan is predicted to be the first of the great apes to face extinction, which may occur within only a few decades (Wich et al., 2008), as numbers have drastically declined. A 16-year study (1999–2015) in Borneo, Indonesia, revealed that an estimated 150,000 orangutans had been lost during this period, reducing the entire population of Bornean orangutans to less than half of the original number when the study began (Sample, 2018).

The popular slash-and-burn technique to clear forests, in addition to the draining of peatlands, is linked to increased greenhouse gas emissions (Sheil et al., 2009), specifically carbon-dioxide (Basyuni et al., 2018; Carlson et al., 2012). This has resulted in Indonesia ranking as

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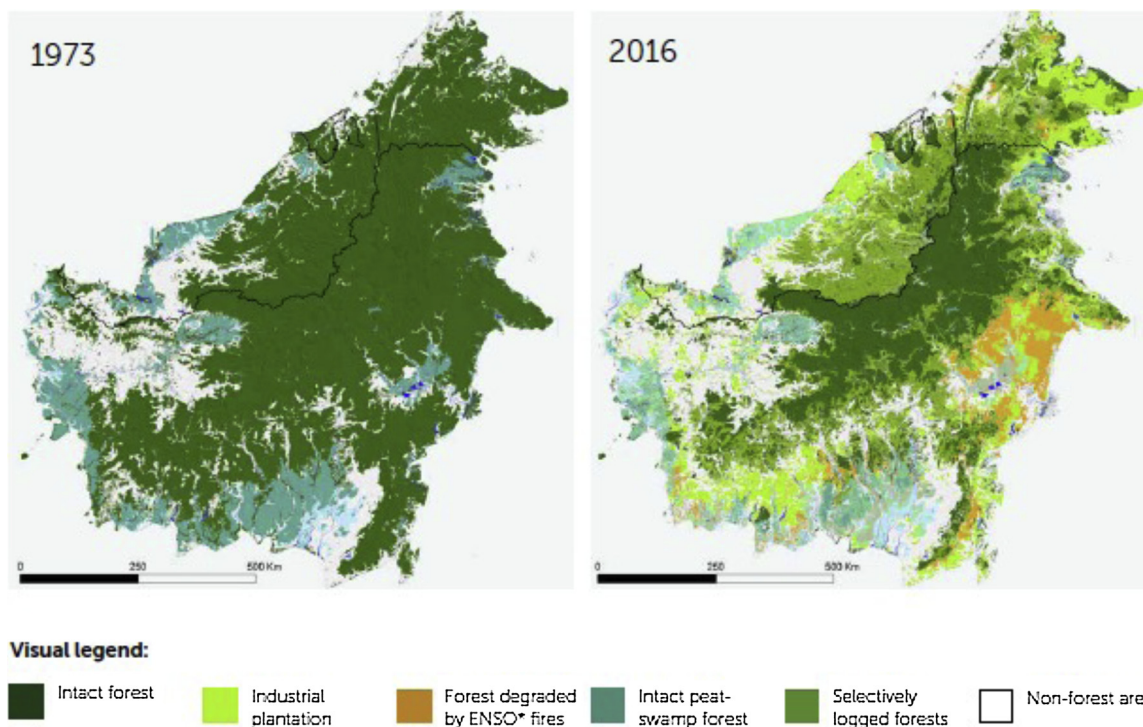


Fig. 1. Forest cover in Borneo island (Indonesia, Malaysia and Brunei) in 1973 and in 2016 indicating the extent of deforestation. Reprinted from “What a difference 4 decades make: Deforestation in Borneo since 1973,” by Gaveau (2017) (http://www.cifor.org/publications/pdf_files/factsheet/factsheet/6552-factsheet.pdf). Copyright [2017] by Center for International Forestry Research (CIFOR), Bogor, Indonesia. Used under Creative Commons Attribution License: <https://creativecommons.org/licenses/by/4.0/>.

the third largest emitter of greenhouse gases in the world (Peace, 2007). The resultant Southeast Asian Haze (affecting not only Indonesia, but also Malaysia, Singapore, and to a lesser degree the Philippines and Thailand) from the burning of peatlands has created health risks, particularly respiratory illnesses, among the locals (Islam et al., 2016; Varkkey, 2012). In 2015 alone, this haze was responsible for an estimated 100,300 premature deaths in these countries, and the pollution generated has been estimated to be greater than that emitted by the entire United States of America (Higonnet et al., 2016).

The loss of forest cover directly and indirectly impacts the people who depend on these forests. In a large study involving approximately 5400 interviews with residents across over 700 villages on the island of Borneo, Meijaard et al. (2013) found that local communities rely on forests for food and medicine, as well as for cultural and spiritual purposes. Tropical rainforests also have direct environmental benefits such as reducing the surface temperature, assisting with water retention, and preventing floods (Meijaard et al., 2013; Wolosin and Harris, 2018). More recent research has revealed that the three main belts of tropical rainforests (Southeast Asia, Congo basin and the Amazon rainforests) play an important role in regulating water cycles, and in turn, global and local temperatures (Wolosin and Harris, 2018). Deforestation, particularly in tropical peatlands, in addition to the use of fire to clear land, have been implicated in climate change impacts (Wolosin and Harris, 2018).

1.2. Potential solutions for the palm oil crisis

Although oil palm agriculture poses immediate threats to the environment and biodiversity (Wilcove and Koh, 2010), the demand for palm oil continues to increase. Owing to its efficiency over other oilseed crops, its penetration into the global economy, and its high profitability, it is impractical to expect the production of oil palm to cease (Meijaard et al., 2018; Wilcove and Koh, 2010). Researchers have posited that encouraging sustainability (i.e., sourcing palm oil from

plantations that have not replaced existing forests) at different levels (e.g., smallholders, medium to large plantations, companies, retailers and consumers) constitute promising solutions to the crisis (Meijaard et al., 2018; Wilcove and Koh, 2010).

The call for sustainability led to the formation of the Roundtable for Sustainable Palm Oil (RSPO) in 2004, as a non-governmental organization whose stakeholders include producers, traders, consumers and investors in the palm oil industry (RSPO, 2018b). While they have been promoting the use of certified sustainable palm, there are mixed reviews about their success. Although RSPO certification has indeed reduced deforestation, this was mainly seen in plantations that had little or no forests left within them prior to certification (Carlson et al., 2018). Further, there appeared to be no significant difference between RSPO certified and non-certified concessions (i.e., areas allocated by a government for industrial-scale oil palm plantations) on metrics of environmental, social and economic sustainability (Morgans et al., 2018). The RSPO has also been accused of “greenwashing” (Lang, 2015; Rahmawati, 2014), which refers to “the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service” (Zudonya, 2011). Following this, the RSPO Complaints Panel commissioned a field review and promised to look into violations (Lang, 2015), although it remains to be seen if this has been effective at addressing the complaints. Recently, the RSPO underwent a revision of its Principles and Criteria, addressing concerns that were raised, and adopting stricter standards regarding deforestation and the use of fire (RSPO, 2018a). If implemented and enforced, the revised standard appears to be a promising approach for reducing deforestation and improving sustainability (Lyons-White and Knight, 2018).

Changing consumer behaviour has the potential to make a significant impact on the environment (Stern, 1999). There is very little research pertaining to consumers assessing specifically how they might be able to have an impact on palm oil production or sales. It has been suggested that boycotting palm oil may be ineffective and produce

deleterious flow-on effects (Wilcove and Koh, 2010). Some have argued that consumers can create a demand for sustainable palm oil by placing pressure on manufacturers and retailers to use palm oil sourced without deforestation (Meijaard et al., 2018; Wilcove and Koh, 2010). These suggested strategies are by no means comprehensive. Further, there is no research available on which of these behaviours (or others) would be most impactful in addressing this ongoing environmental crisis.

In general, although individuals may be motivated to act pro-environmentally, they may lack specific knowledge about what they can do, and/or what would be effective and impactful behaviour (Gardner and Stern, 2008). To be able to influence the palm oil-related ecological crisis, it is important to understand the various pro-environmental behaviours (PEB) that the general public can employ that may have a desirable impact in reducing the abovementioned ecological threats. Lists on effective behaviours to reduce energy usage and water consumption are available (Gardner and Stern, 2008; Inskip and Attari, 2014), as there are concrete means of measuring use and savings. However, with respect to concerns like that of the palm oil crisis, effective behaviour needs to be inferred based on the advice of experts in the field (McKenzie-Mohr, 2011).

1.3. Community-Based Social Marketing (CBSM)

In his book, *Fostering Sustainable Behaviour: An Introduction to Community-Based Social Marketing*, McKenzie-Mohr (2011) proposes a five-step framework to influence PEB. The first step includes selecting potential target behaviours based on their relative ability to reduce a specific environmental problem. This is done by creating a behaviour prioritization matrix (BPM) based on: 1) the extent to which the behaviour will solve the identified problem (effectiveness), 2) the likelihood that members of the target population will adopt the behaviour (probability); and 3) how regularly people already engage in that behaviour (penetration). This formula (effectiveness \times probability \times inverse penetration (maximum possible penetration – observed penetration) = total weighted impact) allows researchers to rank each potential target behaviour in terms of its impact on the problem at hand (McKenzie-Mohr, 2011). McKenzie-Mohr (2011) argues that targeting behaviour solely on effectiveness alone may be unsuccessful. If the target audience indicates a low likelihood of engaging in a highly effective behaviour, behaviour change might be unlikely, requiring larger efforts with fewer results. It is also important to gauge the existing frequency with which people engage in the desirable behaviours. If there exists a relatively high level of penetration, there is little scope for further change (McKenzie-Mohr, 2011). Subsequent steps in the CBSM framework include identifying barriers and benefits to the target behaviour, and designing, evaluating and implementing an intervention accordingly (McKenzie-Mohr, 2011). The utilization of an impact-likelihood matrix has been demonstrated in a case study on water management behaviours, with particular relevance to policy decision making (Kneebone et al., 2017) and the BPM has been applied in prioritising behaviours with reference to wild dog management (Please et al., 2017). The present study aimed to extend the use of the BPM to palm oil-related PEB.

Therefore, the current study had two aims: the first was identifying a list of palm oil-related PEB that a large number of individuals can do, followed by identifying a target behaviour out of this list, based on effectiveness, probability, and penetration. The process undertaken to address these aims is described below in two parts.

2. Method

2.1. Preliminary semi-structured interviews

A qualitative research design was adopted to identify potential PEBs that the general public would be able to perform in order to reduce the negative ecological impact of the expanding palm oil industry.

2.1.1. Participants

Twelve participants, whose experience in the field of interest ranged from 4 to 35 years, were interviewed. Three participants were environmental journalists, one of whom was involved with consumer-related research for the RSPO. One participant was formerly heading research in international forestry and is currently working as a strategy consultant in crop-related deforestation. Six participants were conservation scientists, working in orangutan conservation, landscapes, sustainable agriculture and policy-related decision-making, out of which one had moved on to become a chief sustainability officer at a large conglomerate that owns palm oil plantations. Two participants were activists who run not-for-profit organizations. One of them works towards the protection and conservation of the Leuser ecosystem (one of the world's most biodiversity-rich tropical rainforest in Indonesia), while the other works to promote consumer awareness and action. Participants have been involved with issues related to palm oil in Indonesia, Malaysia, Papua New Guinea, Columbia, England, and Australia. Four of these experts are native to palm oil-producing countries, while five others had spent between 2 to 30 years in these producer countries.

2.1.2. Procedure

Experts were identified based on internet searches and media reports of and by individuals who are actively working with reference to the palm oil crisis. Emails were sent out explaining the research and requesting participation. Participants who consented were interviewed via Skype. Interviews were semi-structured, ranged from 25 to 60 min, and were audio-recorded for later transcription and analysis. Data were collected on the participant's background, his/her involvement in the palm oil crisis, and the person's opinions on what effective palm oil-related PEB are possible for the general public. Six interviews were done via video calls, while the other six were done with audio only, owing to inconsistent internet connectivity on the participants' end. All the interviews were transcribed verbatim, after which they were subjected to a basic thematic analysis (Braun and Clarke, 2006).

2.1.3. Ethics

The study was approved by the Human Research Ethics Committee of the University of New England (Approval No. HE18-184) and in compliance with the recommended research ethics procedure. All participants signed a written informed consent agreement prior to participation.

2.2. Expert and community surveys

A quantitative research design utilizing surveys was adopted in order to compute a BPM of palm oil-related PEB, utilizing potential effectiveness, the probability of adoption and existing penetration of the behaviours suggested by the experts in the preliminary semi-structured interviews.

2.2.1. Participants

Two sets of participants were recruited for the expert and community surveys. The "Experts" group consisted of the environmental experts that had been interviewed in Part 1 of this research. Out of the 12 original participants, 11 provided consent to be contacted for a follow-up survey. From this, 9 experts anonymously completed the survey. The "Community" group consisted of 300 participants (150 women, 149 men, 1 gender unspecified) from Australia, sourced using a survey panel from QualtricsTM, an online database, and survey administrator (Qualtrics, 2019). Participants' ages ranged from 18 years to 87 years, with a median age of 45 years. Most participants (84%) indicated that they had completed Year 12 and/or tertiary or trade qualifications. Seven per cent of the participants were full-time students, 52% were working (employed full-time, part-time) and 22% reported being retired.

2.2.2. Measures

Two surveys were designed, one for each group of participants. For the “Experts”, the survey required participants to rate the effectiveness of 11 palm oil-related PEB (obtained from the preliminary semi-structured interviews) in reducing the negative ecological effects associated with palm oil production, under the assumption that most Australians would adopt the behaviour. Their ratings were on an 11-point scale, where 0 = not at all effective and 10 = extremely effective. Participants were also requested to provide any further suggestions, if any, and rate these as well, and comment on whether any of the listed PEB would negatively affect smallholders.

For the “Community”, participants rated the same list of palm oil-related PEB on penetration - how often the participant has engaged in the desired behaviour in the past 12 months (an indication of frequency of the behaviour on an 11-point scale, where 0 = never and 10 = 10 or more times) and probability - how likely the participant is to engage in the behaviour during the next 12 months (on an 11-point scale, where 0 = not at all likely and 100 = extremely likely, with an interval of 10 points). Additional questions assessing the extent of awareness and concern about the environmental impacts of palm oil production in Southeast Asia were also included, requiring a rating on a 5-point scale (0 = not at all aware/concerned; 4 = extremely aware/concerned).

2.2.3. Procedure

Given that the “Experts” had already been informed of the survey when they had completed their initial interviews, an email with an anonymous survey link was sent out to them. After providing consent, they were requested to complete the short survey; a timeframe of one month was provided. No personal data were collected. “Community” participants were recruited through Qualtrics™ online panel (Qualtrics, Provo, UT). On providing consent, participants completed the survey. Qualtrics™ screened out participants who provided partial responses, or were below 18 years of age. A soft launch with 30 participants was initially done, after which the median time taken was calculated. Participants whose response times were below one-third of this median (less than or equal to 62 s) were automatically screened out as well.

2.2.4. Statistics

Basic descriptive statistics were calculated from the two data sets. From the survey administered to the “Experts”, the average effectiveness rating for each item was computed. In the same manner, from the survey administered to the “Community”, the average probability and penetration rating for each item was computed. These were incorporated into the formula Effectiveness \times Probability \times Inversed Penetration (Maximum Penetration – Observed Penetration), to produce a weighted impact score (McKenzie-Mohr, 2011). Although not part of the initial aim, gender differences were examined (independent samples *t*-test). Additionally, correlations and multiple regression analyses were conducted on key items.

2.2.5. Ethics

The study was approved by the Human Research Ethics Committee of the University of New England (Approval No. HE18-283) and in compliance with the recommended research ethics procedure.

3. Results

The twelve expert interviews yielded several palm oil-related PEB that the general public in Australia can perform. Saturation of ideas was reached by the tenth interview and hence data collected ceased after two additional interviews. Table 1 summarizes all the suggestions of palm oil-related PEB and potential barriers, which were subsequently utilized in the expert and community surveys.

Participants also shared their experiences and perspectives on the palm oil crisis. All of them emphasized that environmental problems, such as this one, are fraught with complexities and rarely is there a

single optimal solution available. A key message that repeatedly emerged was the danger of vilifying palm oil, emerging from an incomplete understanding of the complex variables involved in this crisis. Campaigns in Western countries have focused on the plight of orangutans, using an emotion-triggering narrative to motivate avoiding products with palm oil. However, governments in Indonesia and Malaysia view oil palm expansion as economically beneficial and perceive efforts that discourage palm oil use with suspicion. There is a growing belief by these producer countries that they are being unfairly persecuted by developed countries who may have ulterior motives in promoting other vegetable oils. While highlighting only the orangutan is an oversimplification, there was concern that excessive information might serve to confuse people, which may lead to inaction.

Given its presence in more than half the products we find on supermarket shelves, the dependence of local farmers on this crop in Southeast Asia, and oil palm’s high yield (as compared to all other oilseed crops), all participants believed that working towards sustainability holds the solution for the crisis. Some participants noted that those who strongly criticize the certification path to sustainability have failed to offer viable alternate solutions or suggestions. Another participant reported that pressure to ban palm oil would only serve to alienate and discourage those who are working towards sustainability. Therefore the entire list of potential palm oil-related PEB (except one – avoid or reduce consumption of manufactured food products that contain palm oil) is based on the goal of working towards palm oil sustainability.

All participants mentioned the RSPO and the consensus (except for one participant) was that it was better than nothing, although respondents acknowledged several barriers and the lack of current visible results. In interviews, the RSPO has been referred to as “sub-optimal” and “far from being a perfect process”. Participants believed that improvement was essential for the RSPO, but cautioned against the dichotomous perspective that the RSPO was “terrible and completely untrustworthy” or that it is “excellent”. Some experts suggested that supporting the RSPO would strengthen it and assist advancement, highlighting that compared to other industries (e.g. soybean, beef), palm oil seems to be making the most progress. One expert, whose research highlighted the RSPO’s limited effectiveness, emphasised that there have been “positive constructive discussions” between her research team and the RSPO, “because we all want the same thing”. In her experience, the RSPO has been receptive to constructive feedback, utilizing it to further strengthen its principles and criteria. Another participant was one of the founding architects of the RSPO, although he also acknowledged that he has been a vocal critic of the same. He reported that only about 20% of oil palm companies were members of the RSPO, and it is possible that the remaining 80% are perhaps responsible for most of the ill-effects on the environment. However, one participant in particular had a strong opinion that RSPO facilitated “green-washing.” She believed that it was a broken system, upon which new policies were trying to be built. All participants believed that certification alone likely did not hold the complete answer. The advent of better monitoring technology (like Global Forest Watch) is hoped to assist improved transparency and monitoring regarding the supply chains in the industry, which may enhance trust in sustainability certification schemes.

Given the list of suggestions and complexities expressed, the survey data were utilized to identify which palm oil-related PEB would be most beneficial to target. This was based on the behaviour’s effectiveness in reducing negative ecological effects, having the highest probability of being adopted, and having an existing low penetration in the general public. Table 2 provides information on all these values, including the weighted impact score obtained by multiplying effectiveness, probability and inversed penetration.

Based on the BPM, the behaviour most beneficial to target was purchasing products that contain only sustainable palm oil, thereby encouraging the market for sustainable palm oil. The behaviour with

Table 1
Suggestions of Palm Oil-Related PEB and Potential Barriers.

Palm Oil-Related PEB	Potential Barriers
<u>As a Citizen</u>	
Educate oneself about the palm oil issue and its complexities, so as to have a non-biased perspective; share this knowledge with friends and family.	Complexity of the issue and its different facets Risk of vilifying palm oil Time-consuming
Write/Talk to politicians and local governing representatives about the country's sourcing of sustainable palm oil, for example, to encourage the national government to put a procurement policy in place, or utilize the country's foreign aid policy in a way to put pressure on local governments to enforce sustainability and traceability in their respective countries.	Time-consuming Lack of easy accessibility For a lay person, follow-up may be difficult
Write/Talk to politicians and local governing representatives about informative labelling on all products that can be purchased at a grocery store or supermarket, specifically labelling sustainable and unsustainable palm oil.	Time-consuming Lack of easy accessibility For a lay person, follow-up may be difficult
<u>As an Activist</u>	
Join an NGO/activist/advocacy group that is working in the field of sustainable palm oil, or reducing the adverse impacts of the expanding palm oil industry.	Time-consuming Requires a higher level of commitment and capacity to get involved
Become involved with the RSPO – assisting in making their standards stringent, and working towards achieving them.	Time-consuming Requires a higher level of commitment and capacity to get involved May not be possible at an individual-level – would need to be done as part of an organization
Write petitions to manufacturers, requesting them to switch towards sustainable sources of palm oil.	Time-consuming Politics and landscapes make traceability difficult
<u>As a Consumer</u>	
Avoid products from companies that do not explicitly state that their palm oil is sustainable – as much as possible, purchase products using sustainable palm oil.	Time-consuming to read the labels Labels do not always provide sufficiently accurate information Insufficient options of products containing sustainable palm oil Products containing sustainable palm oil tend to be more expensive Lack of trust regarding the sustainable logo/label Lack of motivation
Avoid or reduce consumption of manufactured food products that contain palm oil (e.g. some types of chocolates, biscuits, crisps, etc.)	
Speak/Write to local retailers, expressing concerns about unsustainability – request them to ensure that products on their shelves legitimately source only sustainable palm oil.	Time-consuming For a lay person, follow-up may be difficult Insufficient options of products containing sustainable palm oil Products containing sustainable palm oil tend to be more expensive
<u>As an Investor and/or Philanthropist</u>	
Make donations to NGOs/organizations working in this field.	Must have the financial capacity to do so
Check whether your bank is financing / supporting companies that continue to have unsustainable practices with respect to oil palm – put pressure on them to be more discerning with their investments.	Time-consuming Must have the financial capacity to do so
Ensure that personal investments do not support companies and manufacturers that source unsustainable palm oil.	Time-consuming to do the research Information may not be easily available (lack of transparency) Must have the financial capacity to do so

the second highest total weighted impact was divesting or not investing in companies that produce or make use of unsustainable palm oil. While experts rated writing to manufacturers to request that they use only sustainably produced palm oil in their products as having a high effectiveness, this had the least probability of being adopted. Avoiding food products containing palm oil (e.g., certain types of biscuits, chocolates, crisps, etc.) had the highest likelihood of being adopted, but the least perceived effectiveness in reducing ecological harm and the least inversed penetration (i.e., relatively more community participants reported that they already engage in this behaviour, so observed penetration was already high).

Awareness and concern about the environmental impacts of unsustainable palm oil production in Southeast Asia were positively correlated to all the probability and penetration items (ranging from $r = .204$ to $r = .672$, $p < .001$). Two multiple linear regression analyses were conducted to predict the existing penetration and the likelihood of purchasing products containing only sustainable palm oil, based on awareness and concern. Together, awareness and concern explained 33% of the variance ($R = .576$, $R^2 = .332$, adjusted $R^2 = .327$) in current sustainable palm oil purchasing behaviour (penetration), and 46% of the variance ($R = .679$, $R^2 = .461$, adjusted $R^2 = .458$) in respondents' projections that they would engage in sustainable palm oil purchasing behaviour in the future (probability).

Further, awareness emerged as a stronger predictor, accounting for 10% of the unique variance in penetration, and 17% of the unique variance in probability. A summary of both regression analyses is presented in Table 3.

Age showed small but significant negative correlations with most probability and penetration items ($r = -.119$ to $r = -.278$, $p < .05$). The younger the age, the more likely individuals were to indicate higher penetration and likelihood. However, with respect to the probability of avoiding foods containing palm oil, the correlation with age was not significant ($r = -.039$, $p = .497$). There were no significant gender differences observed on the probability and penetration items. However, women reported being significantly more concerned about the environmental impacts of palm oil production in Southeast Asia; $t(297) = -2.28$; $p = .023$.

4. Discussion

The present research aimed to generate a list of palm oil-related PEB that the general community in Australia can engage in, followed by identifying a target behaviour out of this list based on effectiveness, probability, and penetration. Eleven potential palm oil-related PEB were identified, out of which "purchasing products containing only sustainable palm oil" received the highest weighted impact score.

Table 2
Behaviour Prioritization Matrix (BPM).

	Expert Online Survey		Community Online Survey		Total Weighted Impact
	Effectiveness (0-10)	Probability (0-10)	Inversed Penetration (0-10)	Penetration (0-10)	
Purchasing only products that contain sustainable palm oil.	7.56	3.74	7.60	214.89	
Divest or not invest in companies that produce or make use of unsustainable palm oil.	7.22	2.37	8.87	151.78	
Discussing the negative environmental impacts of unsustainable palm oil production with family and friends.	6.22	3.24	7.40	149.13	
Seeking information (internet, NGO campaign materials) regarding the negative environmental impact of the palm oil industry.	5.11	3.07	7.60	119.23	
Writing to manufacturers to request that they use only sustainably produced palm oil in their products.	7.89	1.64	9.08	117.49	
Donating money to a local or international organization (e.g., Greenpeace or the World Wildlife Fund) seeking to reduce or eliminate unsustainable palm oil production	5.78	2.25	8.63	112.23	
Contacting a local representative to request that Australia introduce tighter restrictions on the import of unsustainably produced palm oil products.	6.89	1.83	8.85	111.59	
Contacting a local representative to request compulsory labelling to enable consumers to easily distinguish between products containing sustainably and unsustainably produced palm oil.	6.56	1.84	8.80	106.22	
Requesting local retailers and/or supermarkets to not stock products containing unsustainably produced palm oil	5.67	1.76	9.13	91.11	
Avoiding food products containing palm oil (e.g., certain types of biscuits, chocolates, crisps, etc.).	2.89	4.05	6.85	80.18	
Volunteering with a local or international environmental organization (e.g., Greenpeace or the World Wildlife Fund) that work on issues related to unsustainable palm oil production.	5.22	1.65	9.14	78.72	

Table 3
Predicting the penetration and probability of purchasing products containing only sustainable palm oil from awareness and concern.

Dependent Variable	Predictors	B	95% CI for B		β	r	sr ²
			LB	UB			
Penetration	Awareness	1.076**	.763	1.390	.447	.563**	.10
	Concern	.389*	.086	.691	.167	.479**	.01
Probability	Awareness	1.536**	1.223	1.848	.574	.540**	.17
	Concern	.389*	.065	.713	.140	.697**	.01

* p = .01.

** p < .001.

The interviews with experts highlighted the complexities inherent in the palm oil crisis, and confirmed that banning palm oil products was not an optimal or desirable solution (Lyons-White and Knight, 2018; Wilcove and Koh, 2010). These echo findings in the International Union for Conservation of Nature’s (IUNC) report on ‘Oil Palm and Biodiversity’ (Meijaard et al., 2018). Encouraging sustainability was recommended by almost all experts, which is consistent with earlier findings (Meijaard et al., 2018; Wilcove and Koh, 2010). Although there are mixed opinions about the RSPO as a standard of sustainability certification, other certification standards in palm oil such as the Indonesian Sustainable Palm Oil (ISPO) and the Malaysian Sustainable Palm Oil (MSPO) have been deemed to be less credible in terms of environmental protection (Hidayat et al., 2018; Schouten and Bitzer, 2015). At present, hard evidence supporting the RSPO’s effectiveness is lacking (Carlson et al., 2018; Morgans et al., 2018), but the RSPO has indicated that it is open to receiving constructive feedback to improve certification validity (Schouten and Glasbergen, 2011, 2012). It is hoped that the enforcement of their revised Principles and Criteria (RSPO, 2018a,b) will encourage the industry to evolve more sustainably into the future (Lyons-White and Knight, 2018).

Previous research has highlighted the roles of growers, producers, manufacturers and retailers and how they can work towards improving sustainability (Wilcove and Koh, 2010). However, the current study focussed on how members of the community can engage and contribute towards this issue. Using the BPM (McKenzie-Mohr, 2011), the palm oil-related PEB with the highest total weighted impact score was purchasing products that contain only sustainable palm oil, which is a consumer behaviour. The global demand for certified sustainable palm oil is reported to be less than the supply, which is problematic, but can be improved when consumers drive the demand for sustainable palm oil (Lyons-White and Knight, 2018; Schouten and Glasbergen, 2012). It is likely that much of this purchasing behaviour would concern food products, as 80–90 per cent of palm oil produced is used for human food consumption (Shimizu and Desrochers, 2012).

The suggestion of placing pressure on manufacturers and retailers to use only sustainably sourced palm oil (Wilcove and Koh, 2010) had a high potential effectiveness. However, this PEB was judged as least likely to be adopted by the community participants, and therefore would not be the first behaviour to target (McKenzie-Mohr, 2011). Further, one expert mentioned that people in the general community may not have the capacity to follow-up after complaints are made, to ensure that companies adhere to commitments. Therefore, this behaviour can be classified as ‘hard but effective’ (high effectiveness but low probability; Kneebone et al., 2017) and can be addressed at a later stage. It has been suggested that promoting ‘catalytic’ or ‘wedge’ PEBs that are simple and relatively easy (e.g., environmentally-friendly purchasing behaviour) can precede more effective and potentially difficult steps (Thøgersen and Noblet, 2012). Targeting PEB in this manner—taking into consideration effectiveness, probability and penetration—increases confidence that interventions will have the desired outcome (McKenzie-Mohr, 2011).

Awareness about the negative environmental impacts of the

unsustainable palm oil industry in Southeast Asia explained a relatively large amount of unique variance in the probability and penetration of the target behaviour. Knowledge about an environmental issue, possible actions and their consequences, has been identified as a significant factor in a seminal meta-analytic study on PEB (Hungerford and Volk, 1990). Concern about environmental issues has also been highlighted in several studies (Elgaaid, 2012; Schultz, 2000), although it is not always a good predictor of environmental responsibility or purchase choices (Mainieri et al., 1997; Young et al., 2010), which was also reflected in the current study.

4.1. Implications

These findings have several policy-level implications, as the experts have identified potential barriers that might be beyond an individual's control which could prevent him or her from purchasing products that contain only sustainable palm oil. The most apparent barrier is insufficient information on labels, which can prevent consumers from making informed choices. In Australia, palm oil need not be specifically labelled and can be subsumed under the generic term 'vegetable oil' (FSANZ, 2017). An application to label palm oil owing to its negative ecological effects was rejected on the grounds that palm oil did not impact the adequacy of supply, quality or the safety of food, and that international environmental issues were beyond the scope of the Food Standards Australia New Zealand's objectives (FSANZ, 2008). Visible labels describing whether palm oil is present or absent, and further whether it has been sourced sustainably, can assist consumers to make more informed purchases. Further, there are not many options for products that contain sustainable palm oil. One of the experts suggested that the Australian government could consider putting procurement policy in place. In 2012, the United Kingdom government put forth a statement on sustainable palm oil, where they committed to achieving 100 per cent sourcing of credibly certified sustainable palm by 2015 (Defra, 2017). While this has not been fully achieved yet, considerable progress has been made, thus increasing the country's sourcing of sustainable palm oil (Defra, 2017). Finally, as the definition of 'sustainable palm oil' is open to much debate (Defra, 2017; Wilcove and Koh, 2010), working towards a comprehensive, widely-accepted definition would enhance work in the area of sustainability.

4.2. Limitations

Ratings on the potential effectiveness of specific behaviour on reducing the negative ecological effects of the unsustainable palm oil industry were obtained solely from expert ratings. While objective information on current carbon emissions, tree cover loss and forest fire occurrences related to the palm oil (Carlson et al., 2012, 2018) can be obtained, there are no concrete data available on how the identified PEBs might influence rates of deforestation or greenhouse gas emissions. In the absence of this information, reliance on expert ratings is the recommended approach (McKenzie-Mohr, 2011). Further, efforts were taken to minimize potential biases in responses by recruiting experts from diverse backgrounds, including journalists, scientists, activists, and those involved directly with the palm oil industry.

Second, the ratings of probability of adoption and penetration obtained from the community surveys may be subject to social desirability effects, providing inflated estimates relative to actual behaviour (McKenzie-Mohr, 2011). Nevertheless, given these ratings were used to compare the likelihood of adoption and frequency of engagement across all suggested PEBs, any systematic inflation effects should not impact the relative ranks of the Total Weighted Impact scores.

4.3. Conclusions

In conclusion, effectively addressing the palm oil crisis requires a nuanced understanding of the complex trade-offs involving economic,

social and environmental needs. If a majority of consumers restricted their purchases to products containing only sustainable palm oil, this would incentivise plantations and producer countries to adopt sustainable practices. Future research should examine the barriers and drivers of consumer purchasing behaviour of sustainable palm oil products, and investigate behaviour change interventions aimed at increasing the adoption of such practices. Further, utilizing the BPM to select target PEB can ensure that resources are allocated more effectively, by targeting those behaviours that are most likely to have the desired impact on specific environmental concerns.

References

- Basyuni, M., Sulistyono, N., Slamet, B., Wati, R., 2018. Carbon dioxide emissions from forestry and peat land using land-use/land-cover changes in North Sumatra, Indonesia. IOP Conference Series: Earth and Environmental Science 126. <https://doi.org/10.1088/1755-1315/126/1/012111>.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Carlson, K.M., Curran, L.M., Asner, G.P., Pittman, A.M., Trigg, S.N., Adeney, J.M., 2012. Carbon emissions from forest conversion by Kalimantan oil palm plantations. *Nat. Clim. Chang.* 3 (3), 283–287. <https://doi.org/10.1038/nclimate1702>.
- Carlson, K.M., Heilmayr, R., Gibbs, H.K., Noojipady, P., Burns, D.N., Morton, D.C., et al., 2018. Effect of oil palm sustainability certification on deforestation and fire in Indonesia. *Proc. Natl. Acad. Sci. U.S.A.* 115 (1), 121–126. <https://doi.org/10.1073/pnas.1704728114>.
- Defra, 2017. UK Statement on Sustainable Palm Oil: Final Progress Report. Retrieved from. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/590473/palm-oil-final-report.pdf.
- Elgaaid, L., 2012. Exploring the role of anticipated guilt on pro-environmental behavior - a suggested typology of residents in France based on their recycling patterns. *J. Consum. Mark.* 29 (5), 369–377. <https://doi.org/10.1108/07363761211247488>.
- FSANZ, 2008. Rejection of Application - Application A593. Retrieved from. <http://www.foodstandards.gov.au/code/applications/documents/A593%20labelling%20of%20Palm%20Oil%20Public%20Notice%20FINAL.pdf>.
- FSANZ, 2017. Palm Oil. Retrieved from. <http://www.foodstandards.gov.au/consumer/generalissues/palmoil/Pages/default.aspx>.
- Gardner, G.T., Stern, P.C., 2008. The short list: the most effective actions U.S. Households can take to curb climate change. *Environ. Sci. Policy Sustain. Dev.* 50 (5), 12–25. <https://doi.org/10.3200/ENVT.50.5.12-25>.
- Gaveau, D.L.A., 2017. What a Difference 4 Decades Make: Deforestation in Borneo Since 1973. Retrieved from Center for International Forestry Research (CIFOR), Bogor, Indonesia: http://www.cifor.org/publications/pdf_files/factsheet/6552-factsheet.pdf.
- Gilbert, N., 2012. Palm-oil boom raises conservation concerns. *Nature* 487, 14–15.
- Hidayat, N., Offermans, A., Glasbergen, P., 2018. Sustainable palm oil as a public responsibility? On the governance capacity of Indonesian Standard for Sustainable Palm Oil (ISPO). *Journal of the Agriculture, Food, and Human Values Society* 35 (1), 223–242. <https://doi.org/10.1007/s10460-017-9816-6>.
- Higonnet, E., Hurowitz, G., Bellantonio, M., Lapidus, D., 2016. Palm Oil's Black Box: How Singapore's National Wealth Fund Has Fueled a Secret Vehicle for Deforestation From Gabon to Indonesia. Retrieved from. <http://www.mightyearth.org/wp-content/uploads/2016/12/Palm-Oil-Black-Box-PrintApproval4.pdf>.
- Hungerford, H.R., Volk, T.L., 1990. Changing learner behavior through environmental education. *J. Environ. Educ.* 21 (3), 8–21.
- Inskeep, B.D., Attari, S.Z., 2014. The water short list: the most effective actions U.S. Households can take to curb water use. *Environ. Sci. Policy Sustain. Dev.* 56 (4), 4–15. <https://doi.org/10.1080/00139157.2014.922375>.
- Islam, M., Hui Pei, Y., Mangharam, S., 2016. Trans-boundary haze pollution in Southeast Asia: sustainability through plural environmental governance. *Sustainability* 8 (5). <https://doi.org/10.3390/su8050499>.
- Kneebone, S., Smith, L., Fielding, K., 2017. The Impact-Likelihood Matrix: a policy tool for behaviour prioritisation. *Environ. Sci. Policy* 70, 9–20. <https://doi.org/10.1016/j.envsci.2016.11.013>.
- Koh, L.P., Wilcove, D.S., 2008. Is oil palm agriculture really destroying tropical biodiversity? *Conserv. Lett.* 1 (2), 60–64. <https://doi.org/10.1111/j.1755-263X.2008.00011.x>.
- Koh, L.P., Wilcove, D.S., 2009. Oil palm: disinformation enables deforestation. *Trends Ecol. Evol. (Amst.)* 24 (2), 67–68. <https://doi.org/10.1016/j.tree.2008.09.006>.
- Lang, C., 2015. Who Watches the Watchmen? RSPO's Greenwashing and Fraudulent Reports Exposed. Retrieved from. <http://www.redd-monitor.org/2015/11/17/who-watches-the-watchmen-rspo-greenwashing-and-fraudulent-reports/>.
- Lee, J.S.H., Ghazoul, J., Obidzinski, K., Koh, L.P., 2013. Oil palm smallholder yields and incomes constrained by harvesting practices and type of smallholder management in Indonesia. *Agron. Sustain. Dev.* 34 (2), 501–513. <https://doi.org/10.1007/s13593-013-0159-4>.
- Lyons-White, J., Knight, A.T., 2018. Palm oil supply chain complexity impedes implementation of corporate no-deforestation commitments. *Glob. Environ. Chang. Part A* 50, 303. <https://doi.org/10.1016/j.gloenvcha.2018.04.012>.
- Mainieri, T., Barnett, E.G., Valdero, T.R., Unipan, J.B., Oskamp, S., 1997. Green buying: the influence of environmental concern on consumer behavior. *J. Soc. Psychol.* 137 (2), 189–204. <https://doi.org/10.1080/00224549709595430>.

- McKenzie-Mohr, D., 2011. *Fostering Sustainable Behaviour: an Introduction to Community-based Social Marketing*, 3rd ed. New Society Publishers, Gabriola Island, Canada.
- Meijaard, E., Sheil, D., 2013. Oil-palm plantations in the context of biodiversity conservation. In: Levine, S. (Ed.), *Encyclopedia of Biodiversity*, vol. 5. Academic Press, Waltham, MA, pp. 600–612.
- Meijaard, E., Abram, N., Wells, J., Ancrenaz, M., Gaveau, D., Runting, R., Mengersen, K., 2013. People's perceptions about the importance of forests on Borneo. *PLoS One* 8 (9), e73008. <https://doi.org/10.1371/journal.pone.0073008>.
- 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*. IUCN, Gland, Switzerland.
- Morgans, C.L., Meijaard, E., Santika, T., Law, E., Budiharta, S., Ancrenaz, M., Wilson, K.A., 2018. Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives. *Environ. Res. Lett.* 13 (6). <https://doi.org/10.1088/1748-9326/aac6f4>.
- Peace, 2007. *Indonesia and Climate Change: Current Status and Policies*. Retrieved from: https://siteresources.worldbank.org/INTINDONESIA/Resources/Environment/ClimateChange_Full_EN.pdf.
- Please, P.M., Hine, D.W., Skoien, P., Phillips, K.L., Jamieson, I., 2017. Prioritizing community behaviors to improve wild dog management in peri-urban areas. *Hum. Dimens. Wildl.* 23 (1), 39–53. <https://doi.org/10.1080/10871209.2017.1385877>.
- Qualtrics. 2019. Retrieved 22 January, from Qualtrics <https://www.qualtrics.com>.
- Rahmawati, A., 2014. Cleaning up Deforestation From Palm Oil Needs More Than Greenwash. *The Guardian*. Retrieved from: <https://www.theguardian.com/sustainable-business/deforestation-palm-oil-more-greenwash-greenpeace>.
- RSPO, 2018a. *Principles and Criteria for the Production of Sustainable Palm Oil*. Retrieved from: https://www.scsglobalservices.com/files/program_documents/rspo_principles_and_criteria_2018_-_approved_15_november_2018-english.pdf.
- RSPO, 2018b. Retrieved from <https://rspo.org/about>.
- Sample, I., 2018. Dramatic Decline in Borneo's Orangutan Population As 150,000 Lost in 16 Years. *The Guardian*. Retrieved from: <https://www.theguardian.com/environment/2018/feb/15/dramatic-decline-in-borneo-orangutan-population-as-150000-lost-in-16-years>.
- Schouten, G., Bitzer, V., 2015. The emergence of Southern standards in agricultural value chains: A new trend in sustainability governance? *Ecol. Econ.* 120, 175–184. <https://doi.org/10.1016/j.ecolecon.2015.10.017>.
- Schouten, G., Glasbergen, P., 2011. Creating legitimacy in global private governance: the case of the Roundtable on Sustainable Palm Oil. *Ecol. Econ.* 70 (11), 1891–1899. <https://doi.org/10.1016/j.ecolecon.2011.03.012>.
- Schouten, G., Glasbergen, P., 2012. Private multi-stakeholder governance in the agricultural market place: an analysis of legitimization processes of the Roundtables on Sustainable Palm Oil and Responsible Soy. *Int. Food Agribusiness Manag. Rev.* 15 (B), 63–88. Retrieved from: <https://ageconsearch.umn.edu/record/142297/>.
- Schultz, P.W., 2000. Empathizing with nature: the effects of perspective taking on concern for environmental issues. *J. Soc. Issues* 56 (3), 391–406.
- Sheil, D., Casson, A., Meijaard, E., van Noordwijk, M., Gaskell, J., Sunderland-Groves, J., et al., 2009. *The Impacts and Opportunities of Oil Palm in Southeast Asia: What Do We Know and What Do We Need to Know*. CIFOR, Bogor, Indonesia.
- Shimizu, H., Desrochers, P., 2012. The health, environmental and economic benefits of palm oil. *IEM's Economic Note* 1–4.
- Stern, P.C., 1999. Information, incentives, and proenvironmental consumer behavior. *J. Consum. Policy* 22 (4), 461–478. <https://doi.org/10.1023/a:1006211709570>.
- Thøgersen, J., Noblet, C., 2012. Does green consumerism increase the acceptance of wind power? *Energy Policy* 51, 854–862. <https://doi.org/10.1016/j.enpol.2012.09.044>.
- Varkkey, H., 2012. Patronage politics as a driver of economic regionalisation: the Indonesian oil palm sector and transboundary haze. *Asia Pac. Viewp.* 53 (3), 314–329. <https://doi.org/10.1111/j.1467-8373.2012.01493.x>.
- Wich, S.A., Meijaard, E., Marshall, A.J., Husson, S., Ancrenaz, M., Lacy, R.C., et al., 2008. Distribution and conservation status of the orang-utan (*Pongo* spp.) on Borneo and Sumatra: How many remain? *Oryx* 42 (3), 329–339. <https://doi.org/10.1017/S003060530800197X>.
- Wilcove, D.S., Koh, L.P., 2010. Addressing the threats to biodiversity from oil-palm agriculture. *Biodivers. Conserv.* 19 (4), 999–1007. <https://doi.org/10.1007/s10531-009-9760-x>.
- Wolosin, M., Harris, N., 2018. *Tropical Forests and Climate Change: the Latest Science*. Working Paper. Retrieved from: https://wriorg.s3.amazonaws.com/s3fs-public/ending-tropical-deforestation-tropical-forests-climate-change.pdf?_ga=2.18109817.1716992803.1560997024-1126511026.1560997024.
- World Bank, 2018. *World Development Indicators*. Retrieved from: <http://databank.worldbank.org/data/reports.aspx?source=2&series=AG.LND.FRST.K2&country=>.
- World Growth, 2011. *The Economic Benefit of Palm Oil to Indonesia*. Retrieved from Arlington, Virginia: http://www.worldgrowth.org/site/wp-content/uploads/2012/06/WG_Indonesian_Palm_Oil_Benefits_Report-2_11.pdf.
- Wright, T., Rahmanulloh, A., 2017. *Indonesia. Oilseeds and Products Annual Report 2017*. Retrieved from: <https://www.fas.usda.gov/data/indonesia-oilseeds-and-products-annual-1>.
- Young, W., Hwang, K., McDonald, S., Oates, C.J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. *Sustain. Dev.* 18 (1), 20–31. <https://doi.org/10.1002/sd.394>.
- Zudonya, C., 2011. *Defining Green and Sustainability. Housekeeping Solutions*. Retrieved from: <http://www.sinsogreenwashing.com>.