

Impact case study (REF3)

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| Institution: Edge Hill University | | |
| Unit of Assessment: C14 Geography and Environmental Studies | | |
| Title of case study: Increasing palm oil sustainability to conserve Malaysia's tropical peatland | | |
| Period when the underpinning research was undertaken: 2015-2020 | | |
| Details of staff conducting the underpinning research from the submitting unit: | | |
| Name(s): Professor Paul Aplin Dr Christopher Marston | Role(s) (e.g. job title): Professor of Geography Research Fellow | Period(s) employed by submitting HEI: 2015-present 2015-2019 |
| Period when the claimed impact occurred: 2017-2020 | | |
| Is this case study continued from a case study submitted in 2014? N | | |
| <p>1. Summary of the impact Rapid expansion of oil palm plantation into Malaysia's tropical forest is causing irreversible environmental damage, especially greenhouse gas (GHG) emission from converted peat swamp forest. Research at Edge Hill University (EHU) has created a spatial inventory of oil palm and peatland distributions, and quantified the global warming potential of the conversion process; and also developed a collaborative agenda for advancing palm oil sustainability. This research, co-produced with local beneficiaries including environmental NGOs, government bodies and palm oil producers, is being used directly by environmental managers – e.g. Global Environment Centre (GEC) in North Selangor Peat Swamp Forest (NSPSF) – to determine peatland management and restoration practices. Regionally, across southeast Asia, research findings have been exploited by influential non-governmental organisation (NGO), Roundtable on Sustainable Palm Oil (RSPO), to underpin two published Best Management Practice (BMP) manuals on peatland management and oil palm cultivation.</p> | | |
| <p>2. Underpinning research There are four main planks to the underpinning research. First, while there is general awareness about the widespread conversion of tropical forest to oil palm plantation, less is known about the precise spatial footprint of this process or the implications for climate change. Initially, therefore, geospatial analysis was conducted at EHU to map tropical forest/oil palm conversion at the regional (southeast Asia [1]) and local (NSPSF [2]) scales. Moreover, focusing particularly on environmentally valuable tropical peatland, rigorous fieldwork campaigns – including field visits by EHU researchers in 2015 (Aplin) and 2017 (Charters) – were integrated with geospatial findings to calculate regional GHG emissions arising from peat swamp forest/oil palm conversion [1].</p> <p>Second, prior research on estimating GHG emissions from tropical peatland/oil palm conversion has treated the problem as a simple before/after scenario, whereby intact peat swamp forest emissions are compared to those of mature oil palm plantation. Our research considers the conversion <i>process</i>, examining different stages of conversion: secondary peat swamp forest, drained forest, cleared forest/oil palm seedlings, mature oil palm [1, 3, 4]. This research, funded initially via Aplin's (PI) Royal Geographical Society (RGS) research grant (Ralph Brown Expedition Award, 2014-16), showed that GHG emissions reach maximum in the interim stages (drained forest, oil palm seedlings), underlining that before/after comparisons greatly underestimate overall emissions arising from tropical peatland/oil palm conversion.</p> <p>Third, effective and sustainable management of tropical peatland relies on accurate knowledge of carbon storage, and one key element of this is existing forest biomass. Published estimates of above-ground biomass (AGB) vary widely, so we conducted research to develop geospatial methodologies for accurate calculation of AGB in NSPSF [5]. Specifically, full waveform lidar</p> | | |

data – rarely available in tropical peatland environments – was acquired via Aplin's (PI) Natural Environment Research Council (NERC) Airborne Research Facility award (2014-16), and results show that mid canopy lidar metrics are optimal for tropical peatland AGB estimation.

Fourth, the rapid expansion of palm oil agriculture into tropical forests, especially peat swamp forests, has been largely unchecked by environmental (e.g. legislative) safeguards. It is of great urgency, therefore, that sustainable environmental management practices are adopted, and in [6] we create a foundation for this by, through dialogue with a wide range of stakeholders, defining an agenda for palm oil sustainability. Notably, we organised an initial workshop as part of Aplin's RGS project to establish the overarching palm oil sustainability themes.

Collectively, these research efforts (a) increase our fundamental understanding of the tropical peatland/oil palm conversion process, and (b) provide a body of evidence to inform and influence land owners and managers on sustainable stewardship of peat swamp forest environments.

3. References to the research

1. Cooper, H., Evers, S., Aplin, P., Crout, N., Bin Dahalan, M.P. and Sjoergersten, S. (2020) Greenhouse gas emissions peak during conversion of peat swamp forest to oil palm plantation, *Nature Communications*, 11, 407. <https://doi.org/10.1038/s41467-020-14298-w>
2. Charters, L., Aplin, P., Marston, C.G., Padfield, R., Rengasamy, N., Bin Dahalan, M.P. and Evers, S. (2019) Peat swamp forest conservation withstands pervasive land conversion to oil palm plantation in North Selangor, Malaysia. *International Journal of Remote Sensing*, 40, 7409-7438. <https://doi.org/10.1080/01431161.2019.1574996>
3. Tonks, A.J., Aplin, P., Beriro, D.J., Cooper, H., Evers, S., Vane, C.H. and Sjögersten, S. (2016) Impacts of conversion of tropical peat swamp forest to oil palm plantation on peat organic chemistry, physical properties and C stocks, *Geoderma*, 289, 36-45. <http://dx.doi.org/10.1016/j.geoderma.2016.11.018>
4. Cooper, H., Vane, C.H., Evers, S., Aplin, P., Girkin, N. and Sjoergersten, S. (2019) From peat swamp forest to oil palm plantations: the stability of tropical peatland carbon. *Geoderma*, 342, 109-117. <https://doi.org/10.1016/j.geoderma.2019.02.021>
5. Brown, C., Boyd, D.S., Sjoergersten, S., Clewley, D., Evers, S.L. and Aplin, P. (2018) Tropical peatland vegetation structure and biomass: optimal exploitation of airborne laser scanning. *Remote Sensing*, 10, 671. <https://doi.org/10.3390/rs10050671>
6. Padfield, R., Hansen, S., Davies, Z.G., Ehrensperger, A., Slade, E., Evers, S., Papargyropoulou, E., Bessou, C., Abdullah, N., Page, S., Ancrenaz, M., Aplin, P. *et al.* (2019) Co-producing a research agenda for sustainable palm oil. *Frontiers in Forests and Global Change*, 2, 13. <https://doi.org/10.3389/ffgc.2019.00013>

These six outputs were all published following rigorous peer review in leading international journals in the areas of environmental and geospatial science.

4. Details of the impact

By promoting environmental protection of tropical peatland and sustainable practice in palm oil production, this body of research achieves broad societal impact related to tropical peatland ecosystem services: e.g. climate regulation, water and soil management, and biodiversity. Realising onward impact of tropical forest/climate change research is, however, problematic; this is a much-contested subject, where different stakeholder groups (e.g. environmental NGOs, governmental bodies, palm oil producers, local labourers) hold conflicting viewpoints. Also, environmental legislation tends to be piecemeal, and can be ineffective or even non-existent. Here, this research made two direct contributions to ensure onward impact.

Changing environmental management practice in Malaysia

First, at the regional scale, in NSPSF – one of the largest remaining contiguous areas of peat swamp forest in Peninsular Malaysia, spanning 76,000 Ha – research led by EHU (Aplin, Marston) identified encroachment of oil palm plantation into protected peatland [2]. This

information was provided to the NSPSF management body, GEC, enabling targeted measures to tackle illegal smallholder oil palm cultivation. Moreover, this research conducted retrospective monitoring of peat swamp forest condition using archive satellite imagery to demonstrate the relative success of conservation measures such as blocking drainage channels and a logging moratorium. Again, this is crucial information that is being used to underpin current and future management decisions. GEC comment in [A]:

“This body of research has refined our fundamental understanding of tropical peatland dynamics, enabling GEC to improve operational environmental management activities in peat swamp forests such as NSPSF and to promote peatland conservation and environmental sustainability practices, particularly in terms of palm oil production, across Southeast Asia.”

Further influence of EHU’s research on environmental management practice in Malaysia derives from the co-produced palm oil sustainability agenda set out in [6]. This research brought together disparate stakeholder groups – palm oil producers, environmental NGOs, resident groups etc. – to negotiate and agree priority actions to facilitate onward palm oil sustainability. This collaborative research process means that individual stakeholder organisations are now better informed to undertake their occupations, sensitive to the needs of other stakeholder groups. For instance, one of the research partners, HUTAN – Kinabatangan Orang-utan Conservation Project, is involved in both managing tropical forest resources and developing environmental policy, in particular in relation to large-scale oil palm plantations. HUTAN comment in [B]:

“The findings of this research have furthered our understanding of the nuanced conflicting opinions towards palm oil sustainability held by different stakeholder groups, and how conflicts can best be reconciled while safeguarding environmental concerns. HUTAN is now drawing on this body of knowledge when negotiating conservation frameworks with stakeholders such as palm oil producers, and when contributing towards environmental policy directives.”

Impacting international environmental management guidance

Second, across southeast Asia, research findings have been embedded in peatland management practice via publications from an influential NGO, Roundtable on Sustainable Palm Oil (RSPO). RSPO was established in 2004 to develop global standards for sustainable palm oil and is now the world-leading authority on this subject, with over 4,000 member organisations representing all sectors of the palm oil industry, including major producers and regulators. In 2019, RSPO published two manuals on BMPs (Best Management Practices) for oil palm cultivation on peatland [C] and management and restoration of peatland [D]. The global significance of these two manuals is outlined by GEC in [A]:

“These manuals have been mandatory for utilisation of the more than 4000 members of RSPO, which control the production of more than 30% of the world’s palm oil. The implications here are far-reaching, with RSPO guidance being central to palm oil cultivation practices throughout Southeast Asia and world-wide.”

Both of these RSPO manuals [C, D], which have been viewed or downloaded from the RSPO website more than 1,100 times [E], draw directly on the research presented here. Notably, our work calculating GHG emissions from converted peatland, showing how oil palm cultivation contributes to climate change, underpins the guidance issued by RSPO in [C] cautioning against oil palm plantation:

“An assessment of labile carbon (Cooper *et al.* 2019 [4]) in surface soil peats... demonstrated rapid loss of carbon from tropical peatlands following conversion to oil palm plantation... In addition to this, preliminary GHG flux data (Cooper *et al.* in prep [1])... demonstrate that the greatest GHG emissions occur during the conversion phase and highlight the pertinence of the RSPO resolution of no new planting on peat regardless of depth after 15 November 2018 in existing and new development areas.”

In relation to peatland management and restoration, EHU's geospatial analysis is used by RSPO [D] as an exemplar of effective monitoring: "As a result of these [rehabilitation] activities, much of... NSPSF has remained intact despite extensive external development pressures (Charters *et al.* 2019 [2]);" and to signpost exploitation of our new methodologies for future monitoring efforts: "Development of new techniques of monitoring forest cover... using satellite remote sensing technologies may provide useful future tools (e.g. Brown *et al.* 2018 [5])."

The significance of our research findings is underlined by GEC exploiting them when determining national environmental commitments, in terms of GHG emissions, under the United Nations Framework Convention on Climate Change's legally-binding Paris Agreement. As GEC state in [A]: "EHU research has also contributed to work undertaken by GEC to support the revision of Malaysia's nationally Determined Contribution under the Paris Agreement of UNFCCC."

Working mutually with local stakeholders

As noted above, tropical peatland conservation and palm oil production are contested subjects, exemplified by comments responding to our *The Conversation* article [F], co-written by Aplin, on GHG emissions from oil palm plantations. In particular, there is evident disquiet from local (southeast Asian) residents at perceived imposition of research conclusions from international (Global North) research teams, e.g:

"If you wealthy people in the developed nations want to preserve peatlands and swamps in SE Asia which provide jobs for locals and oil at a hugley efficient [sic] rate compared to other crops, you will have to put your hands in your rich pockets and buy the land."

Though uncompromising in tone, these comments are broadly fair and we agree that benefits of the palm oil industry such as cheap produce and job creation must be considered in any discussion [F]. Thus, in anticipation of this issue, we committed in the early stages of this work to full and genuine co-production of research, involving both (a) local (often leading) participants and (b) beneficiaries of the findings. Notably, [1] and [2] were co-authored between UK research partners and Malaysian beneficiaries: GEC and Selangor State Forestry Department (SSFD). Similarly, [6], as well as involving numerous beneficiaries in data collection and research discussion, numbered 12 Malaysian organisations among the authorship, including beneficiaries with varied perspectives such as HUTAN – Kinabatangan Orang-utan Conservation Project [B], Malaysian Palm Oil Board, Malaysian Palm Oil Certification Council and South East Asia Rainforest Research Partnership.

This active commitment to research co-production ensured that research findings were directly useful for, and usable by, beneficiary partners, guaranteeing onward research impact. Mutual research cooperation and benefit is underlined by RSPO [D]:

"Ongoing research focused in peatlands in Selangor, Malaysia by a research consortium comprising Tropical Catchment Research Initiative (TROCARI) in collaboration with The University of Nottingham, Liverpool John Moores University, Leicester University, Edge Hill University, Global Environment Centre and supported by the Selangor State Forestry Department are considering a range of parameters to assess local to landscape-scale changes to landuse cover and impacts to peat function."

Raising wider public awareness

In addition to impact, we are committed to broader public awareness-raising around the societal relevance of research findings. Notably, Aplin was invited to deliver a talk on RGS's world-famous Monday Night Lecture (MNL) series entitled 'Where's the swamp gone, for peat's sake?' [G], and impressed on the 350 or so dignitaries and attendees the need to verify sustainability accreditation when purchasing palm oil products. RGS is the world's largest and most active scholarly geographical society, with 16,000 members and considerable influence around the

globe; MNLs are broadcast live to the membership and recorded versions made available as a permanent online resource [G].

Further public lectures were delivered in EHU's Festival of Ideas (2018) and SustainNET's inaugural meeting (2019). The Festival of Ideas took place throughout May and June 2018, attracting an audience in the thousands from around the region and further afield. The festival theme was 'Equalities' and Aplin's lecture – which was titled 'No, Donald, global warming is *not* an expensive hoax, see!' and presented satellite image analysis as visual evidence of widespread oil palm invasion into pristine tropical forest – emphasised the many benefits of working so closely with local stakeholders in Malaysia. SustainNET is a regional sustainability network co-founded by Aplin at EHU, with dozens of external partners from the commercial, charity and government sectors. Here, Aplin's soap-box talk included a supermarket sweep activity and sustainable palm oil prizes for audience participants. Audience response was extremely positive, such that Aplin was requested to convert the soap-box talk into an 'EHU Talking...' podcast [H].

Further public engagement was undertaken via accessible research reports such as *The Conversation* article described above [F] which was shared hundreds of times via social media platforms. Aplin is also a member of TROCARI (Tropical Catchment Research Initiative) which disseminates topical information related to tropical peatland via social media, especially Twitter.

5. Sources to corroborate the impact

- A. GEC (2021) Testimonial from Global Environment Centre, Kuala Lumpur, Malaysia.
- B. HUTAN (2021) Testimonial from HUTAN – Kinabatangan Orang-utan Conservation Programme, Kota Kinabalu, Sabah, Malaysia.
- C. RSPO (2019a) *RSPO Manual on Best Management Practices (BMPs) for Existing Oil Palm Cultivation on Peat*, Volume 1. Kuala Lumpur: Roundtable on Sustainable Palm Oil. <https://rspo.org/resources/peat/rspo-bmp-for-existing-oil-palm-cultivation-on-peat-volume-1-2018->
- D. RSPO (2019b) *RSPO Manual on Best Management Practices (BMPs) for Management and Rehabilitation of Peatlands*, Volume 2. Kuala Lumpur: Roundtable on Sustainable Palm Oil. <https://rspo.org/resources/peat/rspo-bmp-for-management-rehabilitation-of-peatlands-volume-2-2018->
- E. RSPO (2021) Email from RSPO webmaster detailing website metrics (downloads etc.) for [C] and [D].
- F. *The Conversation* (2020) Palm oil research shows that new plantations produce double the emissions of mature ones. <https://theconversation.com/palm-oil-research-shows-that-new-plantations-produce-double-the-emissions-of-mature-ones-130330>
- G. RGS (2015) Royal Geographical Society Monday Night Lecture: Where's the swamp gone for peat's sake? <https://www.rgs.org/geography/online-lectures/where-s-the-swamp-gone,-for-peat-s-sake/> (also available at https://www.dropbox.com/s/z0x0pk53jdi4zqy/7%20December%202015_%20Where%27s%20the%20swamp%20gone%2C%20for%20peat%27s%20sake_%20-%20Dr%20Paul%20Aplin.mp4?dl=0)
- H. EHU (2020) Edge Hill University Podcast: Talking... Palm Oil and the Environment. <https://www.edgehill.ac.uk/news/2020/01/ehu-podcast-talking-palm-oil-and-the-environment/>