

Institution: University of Sheffield		
Unit of Assessment: A-05 Biological Sciences		
Title of case study: Protecting biodiversity in tropical forests by creating sustainable strategies with logging and rubber industries		
Period when the underpinning research was undertaken: 2013–2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
David Edwards	Professor of Ecology	2013–present
Period when the claimed impact occurred: 2014–2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Over 400 million hectares of tropical forest are selectively logged, while forests in Southeast Asia and Africa are threatened by conversion to natural rubber agroforests, with concurrent major detriment to global biodiversity. University of Sheffield research in Borneo has helped to protect over 400,000 hectares of selectively logged forest from conversion and drive more biodiversity-friendly methods of forest restoration. Edwards' research and direct involvement has highlighted limited potential for carbon-market payments to halt rubber-driven deforestation. He has been instrumental in the development of the Global Platform for Sustainable Natural Rubber (GPSNR), representing ~70% of natural rubber purchasers and including forest sustainability as a core principle.</p>		
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Degradation and conversion of tropical forests is a major driver of the biodiversity extinction crisis and global climate change. Sheffield research across Southeast Asia, sub-Saharan Africa, and the Neotropics has quantified the impacts of selective logging and agriculture on biodiversity and carbon stocks, and identified economically viable management strategies to protect biodiversity. The research has highlighted how conservationists and policymakers can work with loggers and farmers to incentivise protection and recovery of hyperdiverse tropical forests.</p> <p>Selectively logged forests need improved management to maintain high biodiversity levels. Over 400 million hectares of tropical forest worldwide (an area the size of the E.U.) is presently designated for selective logging. Current policies often promote low-intensity logging across large concessions, overlooking the potential for higher-intensity logging restricted to smaller areas within concessions whilst protecting some old-growth blocks. Edwards and his team previously found the latter harvesting strategy would retain more avian and insect species at higher abundances. After the first harvest, logged forests are threatened by early re-entry logging and, ultimately, by conversion to agriculture, as governments and loggers seek further profit. Focusing on Borneo, Edwards and colleagues determined that <i>forests previously logged once and twice still retain high biodiversity</i>, on average supporting over 70% of species found in primary forest, including many at risk of extinction [R1]. Logged forest conversion to agriculture drives catastrophic losses of biodiversity [R1] and severs vital forest connectivity that allows species to move under climate change [R2], underscoring their importance for protection.</p>		

To enhance future timber yields and recover carbon stocks that attract carbon-market payments, the cutting of climbing vines and bamboos that overshadow future harvest trees has been adopted across millions of hectares of logged tropical forest. Edwards' research has revealed that such blanket climber cutting has unintended negative impacts on the phylogenetic and functional diversity of birds, reducing species that eat vine fruits or need dense vine tangles for foraging and nesting [R3]. This underscores the need for climber-cutting strategies that retain some dense climbing vegetation, which occurs in natural tree-fall gaps.

The rubber industry drives deforestation and biodiversity loss, necessitating a sustainability initiative. The expansion of rubber into tropical landscapes in Southeast Asia and Africa is creating similar problems as oil palm. To meet growing rubber demand, production must increase 69% to 18 million tonnes per year between 2010 and 2024, requiring an *additional 4.3-8.5 million hectares of land* [R4]. Tropical forest conversion to rubber agroforest or monoculture plantations poses a huge threat to wildlife across several biodiversity hotspots [R4]. Edwards' research thus highlights the need for the development of a *robust sustainability initiative in the rubber industry* [R4].

Different strategies have been proposed to mitigate forest loss to rubber, including carbon-market payments. However, research by Edwards and colleagues in Cambodia revealed that while logging revenues are sufficiently low to make carbon finance a competitively priced alternative, high rubber profits make carbon financing unfeasible [R5]. *Carbon prices would need to rise from \$5-\$13 to \$30-\$51 t⁻¹ CO₂ to safeguard forests from rubber.* Therefore, producers, purchasers, and governments need to recognise the uncosted social and environmental benefits of forests, and forgo economic revenues from unsustainable rubber to prevent further environmental losses [R5].

3. References to the research (indicative maximum of six references)

- R1. Edwards, D. P.,** Magrach, A., Woodcock, P., Ji, Y., Lim, N. T.-L., Edwards, F. A., Larsen, T. H., Hsu, W. W., Benedick, S., Khen, C. V., Chung, A. Y. C., Reynolds, G., Fisher, B., Laurance, W. F., Wilcove, D. S., Hamer, K. C., & Yu, D. W. (2014). Selective-logging and oil palm: multitaxon impacts, biodiversity indicators, and trade-offs for conservation planning. *Ecological Applications*, 24(8), 2029–2049. <https://doi.org/10.1890/14-0010.1>. (47 citations)
- R2. Senior, R. A.,** Hill, J. K., & **Edwards, D. P.** (2019). Global loss of climate connectivity in tropical forests. *Nature Climate Change*, 9(8), 623–626. <https://doi.org/10.1038/s41558-019-0529-2>. (12 citations).
- R3. Cosset, C. C. P., & Edwards, D. P.** (2017). The effects of restoring logged tropical forests on avian phylogenetic and functional diversity. *Ecological Applications*, 27(6), 1932–1945. <https://doi.org/10.1002/eap.1578>. (7 citations)
- R4.** Warren-Thomas, E., Dolman, P. M., & **Edwards, D. P.** (2015). Increasing Demand for Natural Rubber Necessitates a Robust Sustainability Initiative to Mitigate Impacts on Tropical Biodiversity. *Conservation Letters*, 8(4), 230–241. <https://doi.org/10.1111/conl.12170>. (97 citations).
- R5.** Warren-Thomas, E. M., **Edwards, D. P.,** Bebbler, D. P., Chhang, P., Diment, A. N., Evans, T. D., Lambrick, F. H., Maxwell, J. F., Nut, M., O'Kelly, H. J., Theilade, I., & Dolman, P. M. (2018). Protecting tropical forests from the rapid expansion of rubber using carbon

payments. *Nature Communications*, 9(1), 911. <https://doi.org/10.1038/s41467-018-03287-9>. (27 citations).

4. Details of the impact (indicative maximum 750 words)

Balancing maintained biodiversity in tropical regions which underpin ecosystem services vital for our sustained well-being, while allowing economic development, is a major element of the global climate challenge. Sheffield research has contributed solutions to this problem by extensively studying optimal forest land-management practices for the protection of tropical biodiversity. [Text removed for publication] [S1, S2].

In addition, several of Edwards' articles are cited in the 2018 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Asia and the Pacific report [S3], and 2020 Parliamentary POSTNOTE on Climate Change-Biodiversity Interactions [S4], particularly the conservation value of logged forests, agricultural threats to biodiversity, and roles of carbon funding. Stemming from long-term fieldwork in threatened tropical forests, Edwards has built relationships with national land management departments and global business stakeholders, enabling his research to influence current and future land-use practices.

Impact on forest protection policies

The Sabah Forestry Department, which regulates forestry activities in the second largest state in Malaysia, upgraded over 400,000 hectares of logged forest to Class 1 protected status, equating to ~6% of the state [S1]. [Text removed for publication].

Their protection ensures a permanent buffer around, and connectivity between, the old-growth Danum Valley, Maliau Basin, and Imbak Canyon Conservation Areas. In combination, this block of 679,157 hectares of protected forest '*represents the most important stretch of forest that remains intact on the island of Borneo*' [S1] and is now the largest Totally Protected Area block in Malaysia. This connectivity between protected landscapes is vital for species conservation under climate change [R2].

Impact on local forest-restoration practices

To enhance recovery of Sabah's selectively logged forests, a wide-scale programme of climber cutting has been implemented across 10,000 hectares to reduce competition faced by late successional trees. Following Edwards' suggestion that the intensity of vine cutting should be reduced to minimize biodiversity harm [R3], [Text removed for publication].

Saving vines above this threshold benefits bird groups that rely on vines for foraging, nesting or fruit [R3].

[Text removed for publication].

Impact on rubber industry practices

Following research by Edwards and colleagues [R4], rubber industry stakeholders were increasingly aware of the need to integrate sustainable practices to meet growing demand without irreparable environmental harm. [Text removed for publication].

Edwards has been instrumental in building momentum towards greater incorporation of scientific research into industry-wide initiatives. In November 2017, as the sole academic delegate, he

chaired a workshop session at the Business and Nature Forum in Singapore, entitled ‘Sustainability in Natural Rubber: Progress since Singapore IRSG Focus Forum on sustainability (May 2016) and next steps’, which was attended by major businesses along the supply chain and NGOs. Consequently, the Global Platform for Sustainable Natural Rubber (GPSNR) was established in November 2018 to “improve respect for human rights, prevent land-grabbing, protect biodiversity and water resources, improve yields, and increase supply chain transparency and traceability” [S6].

[Text removed for publication]. Sumitomo Rubber (the world’s fifth largest tyre producer) has produced a Sustainable Natural Rubber Policy resulting from cooperation with GPSNR, seeking to “eliminate deforestation and reduce damage to the environment” [S7].

Edwards has since addressed a workshop in March 2019 involving the 27 GPSNR Founding Members and key stakeholders, including General Motors, Ford, BMW, Bridgestone, Continental, Goodyear Tire and Rubber, Michelin, Sumitomo Rubber, Halcyon Agri, Socfin, and WWF. [Text removed for publication].

As the tyre industry consumes over 70% of natural rubber globally [S6], Edwards’ has contributed to the development of scientifically sound sustainability standards through GPSNR’s Strategy and Objectives Working Group. The group has identified effective strategies to mitigate the root causes preventing sustainability [S8, S9] and [Text removed for publication].

5. Sources to corroborate the impact (indicative maximum of 10 references)

- S1. South East Asia Rainforest Research Partnership (SEARRP) statement about impacts of scientific research in Sabah forests (<http://www.searrp.org/2016/12/31/local-scientists-redraft-malaysias-commitment-to-biodiversity/>).
- S2. [Text removed for publication].
- S3. 2018 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific (<https://ipbes.net/assessment-reports/asia-pacific>).
- S4. Climate Change-Biodiversity Interactions, POSTNOTE Number 617, Parliamentary Office of Science and Technology, Houses of Parliament, February 2020 (<https://post.parliament.uk/research-briefings/post-pn-0617/>).
- S5. [Text removed for publication].
- S6. Global Platform on Sustainable Natural Rubber launch press release, 2018 (<https://www.wbcsd.org/Sector-Projects/Tire-Industry-Project/News/Stakeholders-launch-Global-Platform-for-Sustainable-Natural-Rubber>).
- S7. Sumitomo Rubber Group, Sustainable Natural Rubber Policy, 2018 (<https://www.tyrepress.com/wp-content/uploads/2018/11/SRI-natural-rubber-policy.pdf>).
- S8. GPSNR Desired State document Sept 2020, Strategy and Objectives Working Group [Edwards is a co-author].
- S9. GPSNR Theory of Change, Strategy and Objectives Working Group, January 2020 [Edwards is a member] (<https://gpsnr.org/news-publications/strategy-and-objectives-working-group-update-january-2020>).

