Selective-logging and oil palm: multitaxon impacts, biodiversity indicators, and trade-offs for conservation planning

Abstract

Strong global demand for tropical timber and agricultural products has driven large-scale logging and subsequent conversion of tropical forests. Given that the majority of tropical landscapes have been or will likely be logged, the protection of biodiversity within tropical forests thus depends on whether species can persist in these economically exploited lands, and if species cannot persist, whether we can protect enough primary forest from logging and conversion. However, our knowledge of the impact of logging and conversion on biodiversity is limited to a few taxa, often sampled in different locations with complex land-use histories, hampering attempts to plan cost-effective conservation strategies and to draw conclusions across taxa. Spanning a land-use gradient of primary forest, once- and twice-logged forests, and oil palm plantations, we used traditional sampling and DNA metabarcoding to compile an extensive data set in Sabah, Malaysian Borneo for nine vertebrate and invertebrate taxa to quantify the biological impacts of logging and oil palm, develop cost-effective methods of protecting biodiversity, and examine whether there is congruence in response among taxa. Logged forests retained high species richness, including, on average, 70% of species found in primary forest. In contrast, conversion to oil palm dramatically reduces species richness, with significantly fewer primary-forest species than found on logged forest transects for seven taxa. Using a systematic conservation planning analysis, we show that efficient protection of primary-forest species is achieved with land portfolios that include a large proportion of logged-forest plots. Protecting logged forests is thus a cost-effective method of protecting an ecologically and taxonomically diverse range of species, particularly when conservation budgets are limited. Six indicator groups (birds, leaf-litter ants, beetles, aerial hymenopterans, flies, and true bugs) proved to be consistently good predictors of the response of the other taxa to logging and oil palm. Our results confidently establish the high conservation value of logged forests and the

low value of oil palm. Cross-taxon congruence in responses to disturbance also suggests that the practice of focusing on key indicator taxa yields important information of general biodiversity in studies of logging and oil palm.