

1 **FINE-SCALE DISTRIBUTIONS OF CARNIVORES IN A LOGGING CONCESSION**
2 **IN SARAWAK, MALAYSIAN BORNEO**

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20 Running head: Habitat associations of Bornean carnivores

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22 **ABSTRACT**

23 Coarse-scale patterns of distribution and abundance of species are the outcome of processes
24 occurring at finer spatial scales, hence the conservation of species depends on understanding
25 their fine-scale ecology. For Bornean carnivores, little is known about fine-scale predictors of
26 species occurrence and it is assumed that the two main threats to wildlife on Borneo, habitat

27 disturbance and hunting, also impact their occurrence. To increase our understanding of the
28 Borneo carnivore community, we deployed 60 cameras in a logging concession in northern
29 Sarawak, Malaysian Borneo, where different landscape covariates, both natural and
30 anthropogenic, were present. We built single-species occupancy models to investigate fine-
31 scale carnivore occupancy. Overall, forest disturbance had a negative effect on Hose's civet
32 (*Diplogale hosei*), banded civet (*Hemigalus derbyanus*) and yellow-throated marten (*Martes*
33 *flavigula*). Further, banded civet had greater occupancy probabilities in more remote areas.
34 Logging roads had the most diverse effect on carnivore occupancy, with Hose's civet and
35 masked palm civet (*Paguma larvata*) negatively affected by roads, whereas Malay civet
36 (*Viverra zibetha*), short-tailed mongoose (*Herpestes brachyurus*) and leopard cat
37 (*Prionailurus bengalensis*) showed higher occupancy closer to roads. Canopy height, canopy
38 closure, number of trees with holes (cavities) and distance to nearest village also affected
39 occupancy, though the directions of these effects varied among species. Our results highlight
40 the need to collect often overlooked habitat variables: moss cover and 'kerangas' (tropical
41 heath forest) were the most important variables predicting occurrence of Hose's civet. The
42 preservation of such forest conditions may be crucial for the long-term conservation of this
43 little-known species. Our results confirm that logged forests, when left to regenerate, can host
44 diverse carnivore communities on Borneo, provided less disturbed habitat is available nearby,
45 though human access needs to be controlled. We recommend easy-to-implement forest
46 management strategies including maintaining forest next to logging roads; preserving fruiting
47 trees and trees with cavities, both standing and fallen; and blocks of remote, less disturbed,
48 mid- to high-elevation forest with understorey vegetation.

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50 **KEYWORDS**

51 Borneo, Camera trapping, Carnivores, Forest disturbance, Habitat associations

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