

Correspondence

Small canopy species drive information highways about predators in an Amazonian rainforestEttore Camerlenghi^{1,2,*}, Eliseo Parra³, Jorge Novoa⁴, Daniel T. Blumstein³, José M. Ponciano⁵, and Ari E. Martínez⁶

Interspecies communication networks about threats can shape animal communities, as many species produce alarm calls while eavesdropping on those of others, resulting in information flow crossing ecological niches and taxonomic boundaries^{1–3}. Some species contribute disproportionately to these networks by being particularly vigilant, accurate in predator detection, and consistent in alarm call production. These key informants influence how others perceive danger and produce information used across taxonomic groups^{4–6}. As well, predator encounters by themselves could also alter the soundscape more broadly by producing brief risk-related cues that reach many listeners⁷. However, information about how predator-related information spreads across animal communities remains poorly understood.

Here, we examined the spread of predator information across a megadiverse animal community in the lowland Amazonian forests of Peru (comprising over 370 bird and 10 primate species), focusing on how two species-level traits — body mass and foraging stratum — relate to the likelihood of a species to propagate such information^{1,8}. To simulate alarm propagation, an instance where an individual produces an alarm signal after hearing one, across species and forest strata, we played back combinations of urgent alarm calls from one or more species, including birds and primates, differing in body size and forest stratum (canopy vs. understory). We then recorded the responses of the bird and primate communities in terms of both alarm propagation and overall changes

in the soundscape. We classified species into four body-size and strata classes, which also defined our four playback classes: large canopy (>100 g, canopy-dwelling), large understory (>100 g, understory-dwelling), small canopy (<100 g, canopy-dwelling), and small understory (<100 g, understory-dwelling), using a 100 g threshold informed by prey size partitioning among forest raptors (see Supplemental information). The first two classes included both primates and birds, while the latter two included only birds because there are no primates smaller than 100 g in the community. Playback recordings consisted of paired alarm calls, either from species within the same body-size and strata classes or from different ones. When from the same body-size and strata class, the pairs of alarm calls could be from either the same species or from different species.

We first asked if paired alarm calls from the same species were more likely to induce alarm propagation than heterospecific combinations within the same forest stratum and body size class. A logistic regression focusing on playback recordings from the same body size and forest strata class revealed no significant difference between single-species and multi-species alarm calls in triggering alarm call propagation within the community ($\beta = 0.22$, $SE = 0.56$, $p = 0.699$). We conducted a second logistic regression including all playback combinations to examine whether alarm calls from species of different body size and forest strata classes influence propagation across the broader community. This analysis indicated that the combination of alarm calls from species with different body size and forest strata did not significantly affect the likelihood of alarm propagation within the community. This was supported by a lower Bayesian information criterion for the null model (37.70) compared with the model including playback effects (51.65).

Given that no specific combination of alarm calls from different body size and forest strata classes influenced the likelihood of alarm propagation within the community, we next tested which of the four classes individually was most likely to induce propagation, using logistic regressions (see Supplemental methods). Interestingly, only the ‘small canopy’ class produced a significant result ($\beta = 0.87$, $SE = 0.43$, $p = 0.042$). Such results suggest that alarm calls from

small canopy species are the only ones that significantly increase the likelihood of other species propagating the call within the community.

In addition to being the most effective body size and forest strata class at eliciting alarm propagation during our playback experiment, small canopy species were also the most likely to continue propagating the alarm calls afterward. When we tested whether the four classes differed in their likelihood of propagating alarm calls, our analysis revealed a significant difference ($\chi^2 = 21.44$, $df = 3$, $p < 0.001$), with small canopy species showing a markedly higher tendency to propagate alarm calls than the other body size and forest strata classes (Figure S1). Within this group, we further examined which species were most responsible for alarm propagation and found that two bird species from the genus *Monasa* (*Monasa nigrifrons* and *Monasa morphoeus*) accounted for the majority of these events (56% of the propagation events) (Figure 1 and Data S1B).

Beyond species propagating alarm calls, we further asked whether the overall community soundscape responds to information about risk. To test this, we compared community vocal activity before and after alarm calls. From the 138 bird and primate species vocalizing during our trials, we counted the number of species vocalizing (songs and calls) within each of the four body-size and forest-strata classes (Figure S1 and Data S1C) and calculated the change as the difference between pre- and post-playback values. For each class, we performed a one-sample t-test to assess whether the mean difference was significantly different from zero. To account for multiple comparisons, we applied a Bonferroni correction, adjusting the significance threshold to $\alpha = 0.0125$ (0.05/4). Only small canopy species ($n = 58$) showed a significant change ($t = -3.127$, $df = 140$, $p < 0.01$), with a reduction in the number of species vocalizing after an alarm. No significant change was observed in the other body size and forest strata classes: large canopy ($t = 0$, $df = 140$, $p = 1$), small understory ($t = 0.534$, $df = 140$, $p = 0.593$), or large understory species ($t = -0.726$, $df = 140$, $p = 0.468$).

In summary, our study shows that canopy-dwelling bird species weighing less than 100 g play a central role in



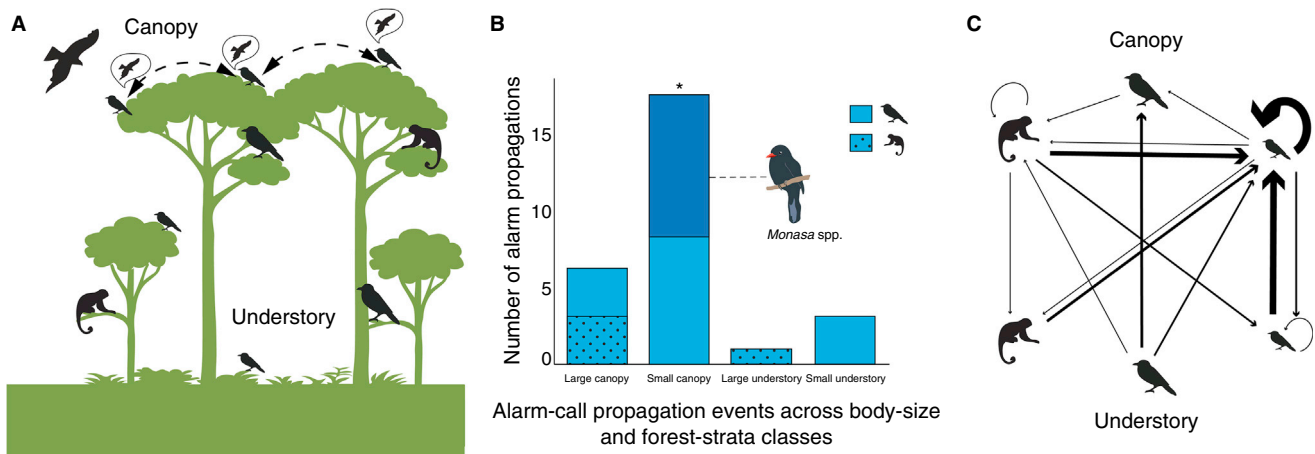


Figure 1. Small canopy species are more likely to propagate alarm calls.

(A) Small bird species (<100 g of body mass) propagate alarm calls through the forest canopy. (B) Within the category of small canopy species, two species — black-fronted nunbird (*Monasa nigrifrons*) and white-fronted nunbird (*Monasa morpheus*) — disproportionately contribute to alarm call propagation. We treated the two species as a single group, as they occupy similar ecological niches and their alarm calls cannot be reliably distinguished. (C) Alarm propagation network across four body size and forest strata classes, plus taxa. In the large canopy and understory classes, primates and birds are represented separately to illustrate alarm propagation across taxa. The arrows point from the signaler in the playback recordings to the receiver (which propagates the alarm), illustrating alarm propagation during the experimental trial. Arrow width represents the frequency of propagation events.

propagating risk-related information within a Neotropical community, as their alarm calls elicited the strongest responses — particularly from other small canopy birds. These strong responses were of two kinds: first, alarm calls of small birds under 100 g caused most other small canopy birds to fall silent, effectively shifting the canopy soundscape; second, some of the other small canopy birds propagated the information by producing their own alarm calls. In particular, bird species from the genus *Monasa* are disproportionately responsible for propagating alarm signals after hearing alarm calls from others, including both birds and primates. Importantly, this study also shows that alarm propagation across taxonomic classes — such as between birds and primates — may be a common feature of risk-related information networks. Furthermore, our findings suggest that shifts in the community soundscape may function as a form of community-wide communication. Our results underscore the importance of studying communication networks at the community level, opening new avenues for exploring how widespread and ecologically significant these patterns are — not only in tropical ecosystems but also beyond. Taken together, these findings highlight the central role of small canopy species in shaping community-wide information flow: by responding

to and propagating alarm calls, they effectively create a functional ‘acoustic highway’ in the canopy.

DECLARATION OF INTERESTS

The authors declare no competing interests.

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SUPPLEMENTAL INFORMATION

Supplemental information including one figure, methods, author contributions, supplemental references and one dataset can be found with this article online at <https://doi.org/10.1016/j.cub.2026.02.006>.

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