Temporal and spatial variability of animal sound within a neotropical forest

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Abstract

Preserved tropical forests are the location of unique, highly diverse, and animal sound. However, although the acoustic behavior of several tropical species has been examined, very few analyses have attempted tropical sounds at a spatial scale able to incorporate landscape characters. Here we analyze the acoustic structure of a neotropical forest landscape in French Guiana. We used a four dimensional synchronous acoustic sampling (three spatial dimensions and the temporal dimension) by deploying an array of 24 microphones in the understory and canopy of the Nouragues Nature Reserve during a 43 day period and we undertook a detailed signal analysis to detect spatial and temporal animal acoustic heterogeneity. We identified a clear pattern of acoustic activity with four distinct periods of activity that differed by their spectral characteristics indicating acoustic heterogeneity along the 24-hour cycle but periodicity at a longer time scale. We revealed acoustic divergences between the understory and the canopy layers in terms of amplitude level and frequency content. We highlighted vertical (understory/canopy) and horizontal acoustic heterogeneities with a more diverse (frequency) patch in the north of the study area sampled and a more active (intensity) patch in the southeast of the study area. Our results show that the soundscape of a tropical forest, in the absence of human disturbance, is subtly structured in time and is heterogeneous in space. This structure is probably linked to endogenous factors that rule out the acoustic time activity of animal species, to the vertical stratification of singing communities or guilds, to horizontal variations in the distributions of species and to vegetation spatial heterogeneity. Our study emphasizes that tropical soundscapes need to be recorded and analyzed in considerable spatial and temporal detail to understand their dynamics without the presence of human produced noise.

Keywords: Soundscape description, spatio, temporal dynamics, tropical forest

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