GI301 Analysis of sound landscapes to assess bird communities in tropical rainforests

The tropical forests of the Guiana Shield support a diverse range of ecosystems hosting incredibly rich bird communities; nearly 1000 species (approximately 10% of the world’s birds), including 150 regional endemics, have been recorded here. This makes conducting ornithological research in the region incredibly exciting, but also potentially problematic for traditional survey methods. The primary technique for surveying birds in dense tropical forests has typically been point-counting, which places a large emphasis on the observers’ skill being sufficient to identify local bird species by sound more often than sight. In some parts of the tropics – such as Operation Wallacea’s Indonesian and Madagascan field sites – the relatively low number of resident species makes the conduct of point counts by ear a viable option for well-trained ornithologists with prior site experience. However, in Guyana the extreme diversity of bird calls an ornithologist must become familiar with to complete traditional point counts effectively is somewhat overwhelming, even if they are highly experienced, and there is great scope for observer error, missing data, and data inconsistencies between survey years.

One solution to the problem of conducting manned point counts in extremely diverse forests such as those found in the Guiana Shield is the analysis of sound landscapes (soundscapes). This technique involves placing powerful omnidirectional microphones at pre-set survey sites to record bird song in the field at set time intervals. The recordings made by these microphones can then be taken out of the forest and analyzed under laboratory conditions. This approach has several key potential advantages over manned point counts. The recordings can be listened to as many times as necessary to ensure the correct species are identified (unlike the ‘snapshot’ judgment an observer completing surveys by ear in the field must use), and ornithologists can use a wide range of computer tools – such as Raven sound analysis software or comparative sound files from on-line libraries such as xeno-canto – to assist in call identification. This means ornithological datasets built up as part of a sound-scaping methodology are likely to be more accurate, more complete, and more consistent between observers than point counts conducted by ear in extremely diverse ecosystems. The creation of a network of microphones collecting information on bird communities remotely across a wide spatial area also allows large datasets to be built up quickly and efficiently, and these large datasets which can be objectively verified more easily than traditional methods could be employed to address a wide range of ecological questions relating to the bird communities of the Guiana Shield.

While the potential for sound-scape methodologies in Neotropical forests is great, the technique is currently still at a fairly early stage of its development and students with an interest in this project have an exciting opportunity to trial an emerging technique with great scientific potential. Students taking this dissertation option in 2015 will work within teams placing microphones at a series of points across a spatially extensive area of lowland neotropical forest. These microphones will be timed to record dawn and dusk choruses at two 1.5 hour time intervals starting just before dawn and 1.5 hours before dusk respectively. These time periods will be used as they correspond to the two peaks of bird vocalization activity. Students will then analyze each recording made in laboratory conditions and, with the help of
experienced ornithologists and potentially sound spectrographs generated by Ravensoftware, identify all bird species present in each recording.

Students taking this research option will spend a large proportion of their time recovering and analysing these sound recordings, but they will be involved with other ornithological survey work as well, principally mist-netting, which involves capturing understorey birds in fine mesh nets, measuring their biometrics, fitting them with an identification ring, and releasing them. The completion of mist-netting surveys, which typically detect many cryptic understorey species, at each sound recording site will allow students to gauge whether species identified in the soundscape recordings are an accurate reflection of true bird diversity at that given point – i.e., if most species detected by mist-nets are also present in the sound recordings, that is indicative that the sound recordings are representative of diversity at the site.

The combination of sound recording analysis ground-truthed by mist-netting surveys will allow students to answer a wide range of questions relating to ornithological field methods and the avifaunal communities of the Guiana Shield in general. Methods-based research themes could tackle questions relating to the effectiveness of soundscaping as a field technique. These would be highly novel given the emerging status of this approach to survey work. Students examining data from this approach could test the representativeness of sound-scape recordings by comparing the species recorded by this method with other methods such as mist-netting, as previously discussed. Students could also test the hypothesis that soundscape recordings are a more accurate, consistent and objective methodology than manned point counts by comparing the recordings with results of counts conducted by ear taken at the same time and location, and seeing how the results differ, or getting different observers to analyze the same set of sound recordings and testing the consistency of the species identified.

Students wishing to use soundscape analyses to answer questions about the bird communities of the Guiana Shield more generally also have a range of potential research approaches to choose from. By collecting simple habitat structure measurements such as mean tree size and frequency of larger trees, tree height, canopy density and undergrowth density at plots centered on each recording site, students would be in a position to examine how different habitat factors effect community composition, richness, and the distribution of particular species. These kinds of analyses could also be used to gauge how soundscape recordings can be used to assess the conservation value of different broad forest disturbance types for local bird communities, and in particular examine how composition of bird communities differs between logged areas and unlogged areas to understand the effect of reduced-impact logging. Students wishing to take a more behavioral approach to data analysis also have numerous options. One potential option might be, for example, to combine sound recording analysis and morphometric measurements taken from the mist-netting survey to test the hypothesis that eye-size can be an important function of song order in the dawn chorus.

In summary, this research option offers dissertation students a wide range of possibilities to investigate research questions using an emerging ornithological survey tool. This overview identifies a few of these possibilities, but many other applications of the soundscaping technique may also be possible. Whichever research questions students ultimate choose, they will be working with large, high quality
datasets and will be well placed to conduct novel studies into the spectacular avifauna of the Guiana Sheild forests.

**Suggested Reading**


