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**Title:** Evaluation and Application of a Deep Neural Network, BirdNET, for Bird Sound Detection

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**Abstract (250 words):** Spatiotemporal variation of avian biodiversity is a commonly used indicator of environmental change. Conventionally, such information was derived with human observers, while passive acoustic monitoring (PAM) with autonomous recording units (ARU) is rapidly emerging as an alternative survey method. Given the large amount of acoustic data PAM can potentially collect, effort has been made to develop algorithms to automatically transform acoustic data into interpretable form. Recently, one of the most successful attempts is a deep neural network called BirdNET, that is able to identify 984 North American and European bird species by their sound. However, a systematic evaluation of such neural network is lacking. In this study, we aimed to evaluate the accuracy of BirdNET for detecting bird species. A total of 66 ARUs were set up in John Prince Research Forest, Canada during 2020 and 2021 May - July, resulting in about 67,000 one-minute recordings (about 1,000 hours) of acoustic data. We applied BirdNET on the dataset and accessed the accuracy metrics for 20 common local species that perform different levels of vocal activity. Specifically, we selected 180 3-second sound segments for each species and compared the observed detection (by human listener) and predicted detection (BirdNET detection confidence). Our results indicate that BirdNET performed with varying accuracy across different species and habitats. This study provides a foundation for future studies that requires application of automatic detection in avian biodiversity monitoring using PAM techniques.

**Key words**: BirdNET, automatic detection, identification, vocalization