Report on the use of passive acoustic monitoring in Kluane National Park Reserve

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Abstract

Passive acoustic monitoring has proven to be a valuable tool for monitoring vocalizing species. Environmental sensors are becoming increasingly easy to program and can autonomously generate extensive data sets of the soundscape, becoming an invaluable resource for ecological integrity monitoring. Kluane National Park Reserve deployed autonomous recording units (ARUs) across 10 locations, participated in the national Prescribed Burn protocol. ARUs detected a total of 16 species including birds, amphibians and mammals. Despite failures from 2 locations, the analysis revealed...

Land Acknowledgement

In the spirit of Reconciliation, we respectfully acknowledge that the lands of Kluane National Park Reserve where this study took place are the traditional territories of the Southern Tutchone people represented in the Kluane region by the Champagne and Aishihik First Nations and the Kluane First Nation. Champagne and Aishihik First Nations, Kluane First Nation and Parks Canada are jointly responsible for the management of Kluane's natural and cultural resources.

Introduction

Human activities have been identified as key pressures and contributors to the global decline in forest wildlife (Allan et al. (2017)). The repercussions of habitat fragmentation (Fahrig (2003)) and loss (Hanski (2011)), climate change (Mantyka-pringle, Martin, and Rhodes (2012), Sattar et al. (2021), Abrahms et al. (2023)), and increased access to sensitive areas exert direct and indirect pressures on forest biodiversity, particularly in managed regions in Canada (Lemieux et al. (2011)). In 2023, Kluane National Park Reserve initiated a program incorporating autonomous recording units (ARUs) for passive acoustic monitoring (PAM) of the Park's wildlife. ARUs are compact environmental sensors that are designed to passively record the environment (Shonfield and Bayne (2017)), capturing vocalizing species like birds and amphibians, which is growing in use across the globe (Sugai et al. (2018)). This technology enables resource managers to conduct prolonged surveys with minimal human interference. The subsequent data collected by these units contribute valuable information to ecological integrity metrics such as species richness, diversity, occupancy, and trends over time. This data aids decision-making and management within the Park. Given the rapid and ease of accumulating data from these units, maintaining a high standard of data integrity is paramount to ensure future data interoperability and sharing. WildTrax is an online platform developed by the Alberta Biodiversity Monitoring Institute (**ABMI**) for

Allan, James R, Oscar Venter, Sean Maxwell, Bastian Bertzky, Kendall Jones, Yichuan Shi, and James EM Watson. 2017. "Recent Increases in Human Pressure and Forest Loss Threaten Many Natural World Heritage Sites." *Biological Conservation* 206: 47–55.

Fahrig, Lenore. 2003. "Effects of Habitat Fragmentation on Biodiversity." *Annual Review of Ecology, Evolution, and Systematics* 34 (1): 487–515.

Hanski, Ilkka. 2011. "Habitat Loss, the Dynamics of Biodiversity, and a Perspective on Conservation." *Ambio* 40 (3): 248–55.

Mantyka-pringle, Chrystal S, Tara G Martin, and Jonathan R Rhodes. 2012. "Interactions Between Climate and Habitat Loss Effects on Biodiversity: A Systematic Review and Meta-Analysis." *Global Change Biology* 18 (4): 1239–52.

Sattar, Q, ME Maqbool, R Ehsan, S Akhtar, Q Sattar, ME Maqbool, R Ehsan, and S Akhtar. 2021. "Review on Climate Change and Its Effect on Wildlife and Ecosystem." *Open J Environ Biol* 6 (1): 008–14.

Abrahms, Briana, Neil H Carter, TJ Clark-Wolf, Kaitlyn M Gaynor, Erik Johansson, Alex McInturff, Anna C Nisi, Kasim Rafiq, and Leigh West. 2023. "Climate Change as a Global Amplifier of Human–Wildlife Conflict." *Nature Climate Change* 13 (3): 224–34.

users of environmental sensors to help addresses these big data challenges by providing solutions to standardize, harmonize, and share data.

The objectives of this report are to:

- Describe the data management and processing procedures for the acoustic data collected in 2023;
- Utilize traditional human tagging to detect and count species heard on recordings;
- Define straightforward methods for evaluating species presence, species richness, and species occupancy;
- Offer recommendations for ongoing monitoring approaches to contribute to the assessment of ecological integrity in forest ecosystems and prescribed burn management in the park;
- Facilitate data publication to the public, resource managers, academic institutions, and any other relevant agencies

Methods

Data collection and management

Data were collected during spring and summer of 2023. A total of 10 locations were surveyed, encompassing sites at Alder Creek (`AC-`) and Jarvis River (`JR-`), each with five locations. In each site, 3 locations were designated for a prescribed burn in 2024 (e.g. `AC-T1`), with 2 locations serving as unburned controls (e.g. `JR-C1`). Surveys were conducted on a rotational basis, as outlined in Table 1 (Table **??**) and depicted in Figure 1 (Figure **??**). ARUs were deployed at the onset of the breeding bird season (May-June) and rotated among locations until retrieval in July-August. Each ARU recorded for an average of 6.27 +/- 5.66 days. Recording schedules were standardized, comprising morning sessions at 05:30, 06:30, and 07:30, and evening sessions at 22:45 and 23:45. Evening recordings targeted species such as Varied Thrush, Common Nighthawks, and owls. Station installations remained constant throughout the monitoring period, with Alder Creek stations established on May 24th. For