Report Partner Document

PTAC – AUPRF 2024 Pileated Woodpecker Report

PTAC

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This partner document has been created to provide a non-technical summary of information presented in PTAC – AUPRF 2024 PILEATED WOODPECKER REPORT (2024) referred to in this document as "The 2024 Annual Report", prepared by Brendan Casey, Simran Bains, and Erin Bayne for and with funding by Petroleum Technology Alliance Canada (PTAC) and Alberta Upstream Petroleum Research Fund (AUPRF). Additional background information is provided in this partner document to supplement the readers understanding of progress presented in The Report.

Introduction

The 2024 Annual Report details the progress of the Pileated Woodpecker (PIWO) Project, a collaborative initiative aimed at enhancing the detection and protection of PIWO nesting sites in Alberta. The project is funded by PTAC and AUPRF, reflecting a partnership between industry stakeholders and conservation researchers. The research team comprises experts in wildlife ecology, remote sensing, and bioacoustics, working together to develop innovative methodologies for monitoring PIWO populations.

Background Information

The PIWO is North America's largest woodpecker species, recognizable by its striking red crest and distinctive drumming sounds. Primarily inhabiting mature deciduous and mixed forests, PIWOs rely on large, dead, or decaying trees for nesting and foraging. Their diet mainly consists of carpenter ants and wood-boring beetle larvae, making them integral to forest health by controlling insect populations. Moreover, the cavities they excavate serve as essential nesting sites for various other species, underscoring their role as a keystone species in forest ecosystems.

The conservation of PIWO habitats has gained increased attention, especially following amendments to the Migratory Birds Regulations in 2022, which now protect PIWO nesting cavities for up to 36 months after they become inactive. This change necessitates more effective methods for detecting and monitoring these cavities to ensure compliance and conservation.

Predictive habitat modeling has emerged as a vital tool in this context. By analyzing environmental variables such as forest composition, canopy height, and vegetation indices, researchers can identify potential PIWO habitats. Advancements in remote sensing technologies, including the use of Sentinel-2 and Landsat imagery, have enhanced the accuracy of these models. Additionally, the deployment of Autonomous Recording Units (ARUs) allows for the passive monitoring of PIWO vocalizations and drumming patterns, providing insights into their presence and nesting behaviours.

Project Summary

In 2024, the PIWO Project undertook extensive fieldwork across over 511 hectares in Alberta, employing a combination of systematic and opportunistic surveys to locate PIWO cavities. A total of 188 ARUs were deployed to capture acoustic data, facilitating the correlation between drumming behaviours and cavity presence.

HABITAT MODELING

The foundation of the PIWO Project is its advanced habitat modeling strategy, which predicts the presence of PIWO using environmental data. In 2024, researchers refined a predictive model using Boosted Regression Trees (BRTs), which incorporated both remote sensing data and bioacoustics

observations. This model utilized data from Landsat and Sentinel-2 satellites, integrating variables like broadleaf forest cover, canopy height, tree senescence, and topographical wetness.

The model was trained on over 72,000 point count records collected across Alberta from 2010 to 2022. These counts included both human and automated acoustic surveys conducted primarily during the summer. The analysis revealed that the proportion of deciduous trees, canopy structure variability, and indices of vegetation stress (Distance Red and SWIR Index) were significant predictors of PIWO presence. Particularly, broadleaf coverage exceeding 75% and canopy heights above 25 meters were strongly associated with woodpecker activity, notably drumming which is an important breeding signal.

FIELDWORK

Guided by the predictive model, field teams conducted extensive surveys in Alberta's forested regions, totaling approximately 511 hectares. Sites were chosen through stratified random sampling to represent a gradient of predicted habitat quality, from low to high suitability. Surveys were conducted between March and October 2024 using a standardized one-hectare search protocol developed by Simran Bains.

Field teams systematically divided each hectare into transects and recorded all potential nesting cavities and foraging trees. In addition to planned survey sites, opportunistic and incidental discoveries were documented, allowing for greater spatial coverage and diversity in habitat types. ARUs were deployed in the center of 188 of the surveyed blocks to collect continuous sound data for further behavioural analysis and model validation.

CAVITY DETECTION

A major outcome of the project was the identification and classification of nesting cavities. Cavity diameters were categorized to estimate their suitability for PIWOs and other cavity-nesting species. From July onward, the project documented cavities based on systematic searches and random and incidental findings.

The team also launched a mobile application through Epicollect5 that enables field personnel and public contributors to record cavity locations in real time. This tool not only helps track cavity densities but also builds a database to inform future research and conservation planning.

DRUMMING BEHAVIOUR STUDY

The study of PIWO drumming and vocal behaviour formed a novel component of the project. Researchers analyzed ARU recordings to determine the frequency and patterns of drumming and calling in different contexts, such as at active nests, old nests, feeding trees, and control sites. By comparing the acoustic signatures, the team aims to identify cues that indicate the presence of active nesting.

Initial findings suggest that a combination of acoustic features including drumming intensity, the ratio of calls to drums, and presence of juvenile vocalizations can reliably indicate nesting activity. The ultimate goal is to reduce the need for labour intensive nest searches by developing a predictive acoustic model. This approach mirrors similar work done with species like the Common Nighthawk, where vocalizations successfully indicated nesting territories.

WEB APPLICATION

To support data sharing stakeholder engagement, the team enhanced a Google Earth Engine-based web application. This platform consolidates predictive habitat maps, known cavity locations, and fieldwork summaries. It also overlays relevant planning layers, including human footprint and industrial infrastructure, to assist with environmental impact assessments and land-use decision making.

This application functions as a central decision support tool for government regulators, industry planners, and conservationists. It ensures that real-time, data driven insights can be used to mitigate impacts on protected species like the PIWO.

MODEL VALIDATION

Validation of the Sentinel-2 predictive habitat model was carried out using data from the 511 hectares of systematically searched land. The model achieved strong performance metrics, with an area under curve of 0.81, indicating high classification accuracy, a log loss of 0.32, and Brier score of 0.09. These values confirm the model's reliability in predicting PIWO presence and cavity locations.

The validation process will continue as more field and acoustic data become available. Ultimately, separate models for nest presence and acoustic activity will be developed to enhance regulatory and management decisions.

Conclusion

The 2024 PIWO Project has made significant strides in enhancing the detection and protection of PIWO nesting sites in Alberta. Through the integration of predictive habitat modeling, remote sensing, and acoustic monitoring, the project has developed robust methodologies for identifying and monitoring PIWO habitats. These advancements facilitate compliance with updated conservation regulations and contribute to the broader understanding and preservation of forest ecosystems.

Continued efforts are recommended to refine these methodologies, particularly in improving camera-trapping techniques and integrating photogrammetry with acoustic data. Such enhancements will further bolster the effectiveness of monitoring programs, ensuring the sustained conservation of the PIWO and the myriads of species that depend on its ecological role.