

# Factors Affecting Acoustic Detection of Mexican Spotted Owls at Grand Canyon National Park

VANESSA RAMIREZ, KIRSTEN FULLER, EMILY SALCICCIA, JENNYFFER CRUZ

## Introduction

Wildlife conservation and management rely on accurate estimates of species demographics. However, cryptic or rare **species are often detected imperfectly, which can lead to erroneous estimates of demography that may misguide wildlife managers**. Passive acoustic monitoring is a novel and potentially promising method used to detect vocal wildlife. Custom sound recorders have been used in Grand Canyon National Park to monitor Mexican Spotted Owls (*Strix occidentalis lucida*) since 2019, but the factors that influence detection are not yet fully understood.

## Research Questions

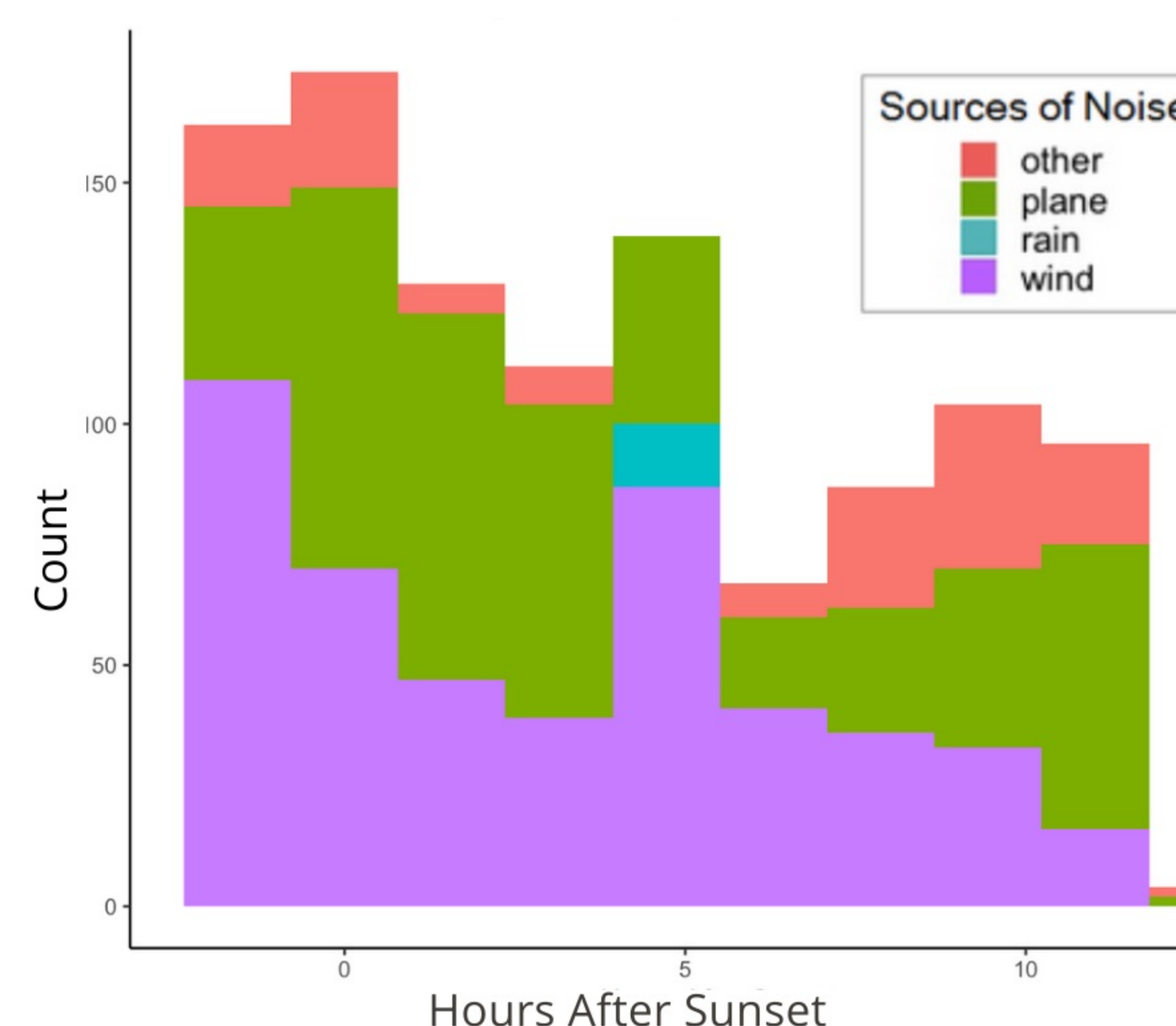
1. What are the main **sources of noise** and when do they occur?
2. How do **wind, weather, time, and day of year** influence detection?
3. How do **habitat type** and **recorder ID** influence detection?

## Methods

- Processed sound data from **owl surveys** by extracting (1) sources of noise (type, time, and duration) and (2) owl detections
- Obtained **weather data** from nearby weather station
- Conducted **recorder trials** with consistent sound at 5 meter increments from 0 m to 150 m
- Summarized noise data
- Analyzed factors influencing owl detection using logistic regression
- Analyzed recorder trials using distance sampling with half-normal distributions

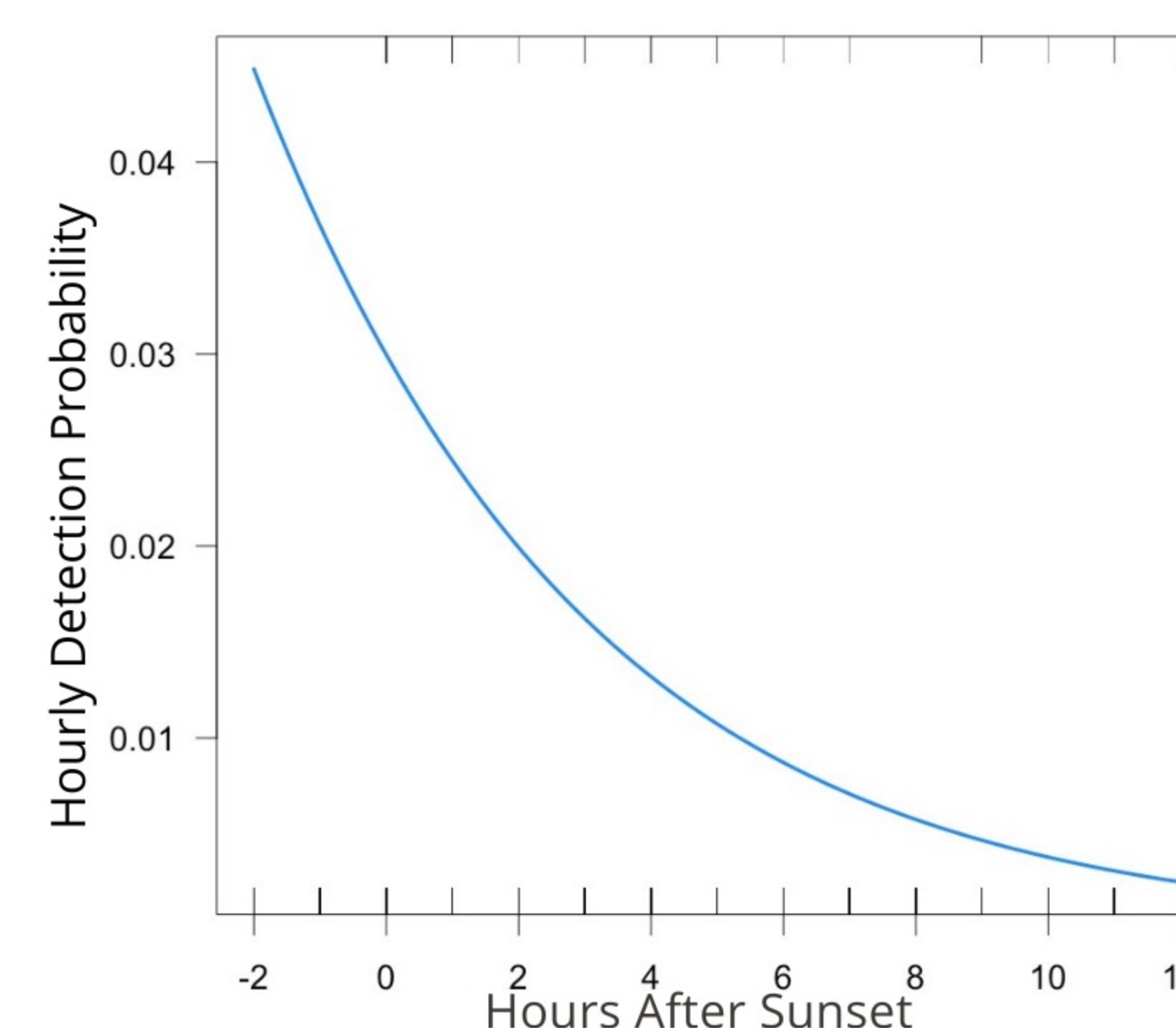
## Results

### 1. Noise Detected During Owl Surveys



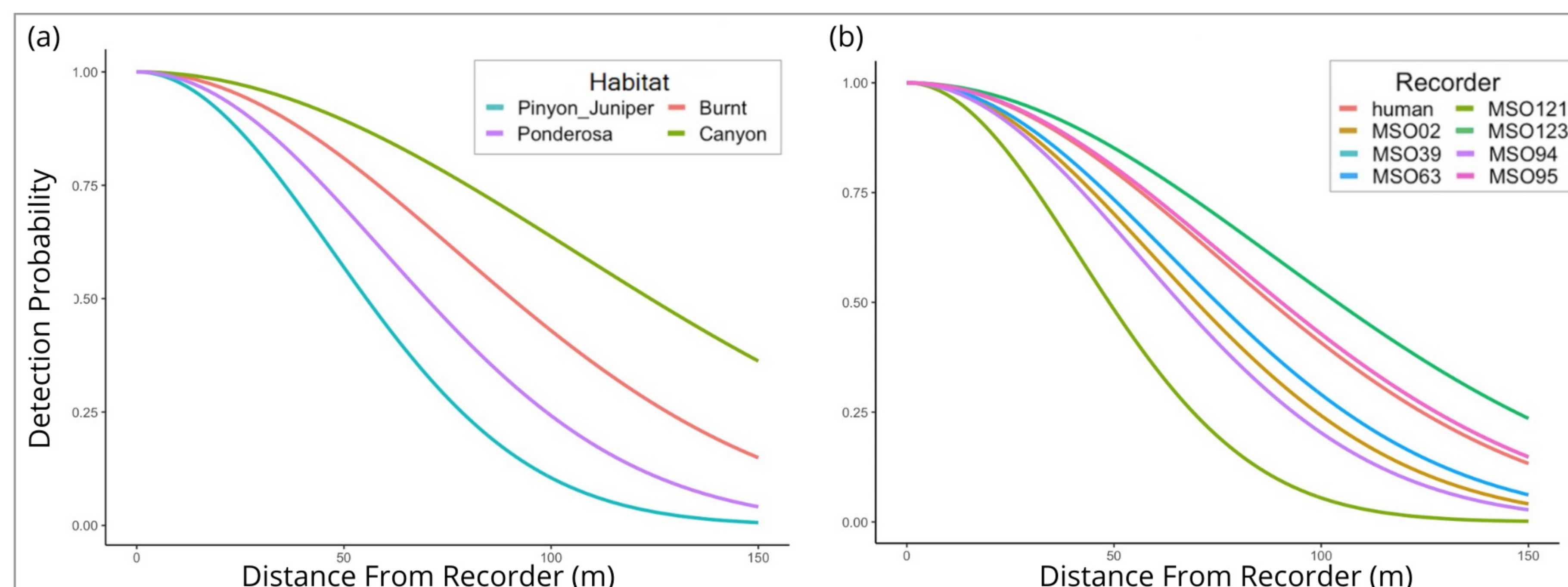
1. Sources of noise in owl survey recordings were categorized as wind, rain, airplane, or other (human voices, other birds, and other animals), and their time of occurrence and duration were summed.

### 2. Influence of Wind, Weather, Time, and Day of Year on Detection



2. Logistic regression model showing time of night as most significant influence. Detection probability is highest 2 hours before sunset and decreases as the night progresses.

### 3. Influence of Habitat Type and Recorder ID on Detection Probability



**3(a)** The probability of detecting sound by the recorders was higher at further distances in canyon habitat. Detection probability dropped faster in closed forest.

**3(b)** Recorders varied widely in their ability to detect sound. For example, in ponderosa forest, some only dropped to 0.75 probability of detection at 100m, while others dropped to < 0.25.



## Discussion

- **Wind and planes were the dominant sources of noise**, occurring during times when Mexican Spotted Owls were most vocally active.
- Recorders detected sound at **further distances in canyon** habitats.
- In closed forests, detection probability was low (< 0.25) at 100 m.
- The custom sound recorders, although affordable, provided unreliable detection. For some recorders, high detection (> 0.75) only occurred at < 50 m.
- Confidence in assigning non-detections as true absences is low; owls could be easily missed.
- **Passive acoustic monitoring remains a promising method** but further work is required before it can be confidently implemented at the Grand Canyon.

## Acknowledgements

We thank Mark Szydlo for designing the custom recorders, NSF and Department of Defense REU Site Award, Boise State University Raptor Research Center, and the NPS for funding and support.

## Abstract & References

