

Introduction

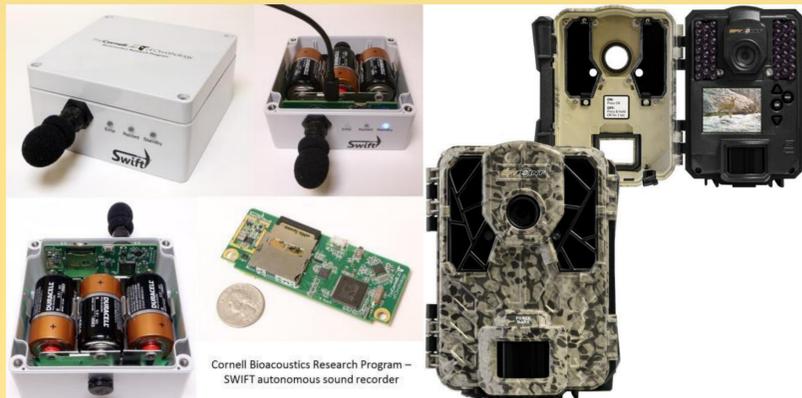
- Acoustics offer a newer form of detection that increases the detection range beyond that of traditional camera traps.
- This collection method offers - abilities to generate multiple different species detections across a soundscape, detection of forms of disturbance, and vocal behavior.
- The detection, isolation, and databasing of vocal patterns, and survey specific individuals that are normally hard to approach such as timber wolves (*Canis lupus*) and lions (*Panthera leo*)(Garland et al. 2020).
- Our study will provide valuable information concerning the ability to detect coyotes (*Canis latrans*) using acoustic and camera trap data and will aid in the development of databases to be used for management of this important furbearer and meso-predator.



Example of the camera trap data from the Coffey Ranch

Objectives

1. To analyze commercially available programs for the detection of coyote vocalizations to assist in collection of detection data and look at performance.
2. To compare and evaluate the detection difference between acoustic monitors and camera traps as well as look into the increased effectiveness of using both to increase detection success.
3. To generate occupancy models using both data collections to determine coyote occupancy of the two properties.
4. To better understand how covariates affect both data collection methods

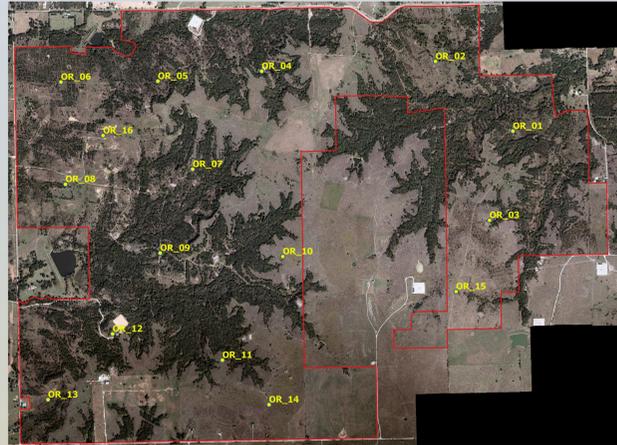


An example of the Swift Acoustic Monitor used in the study to record the soundscape .

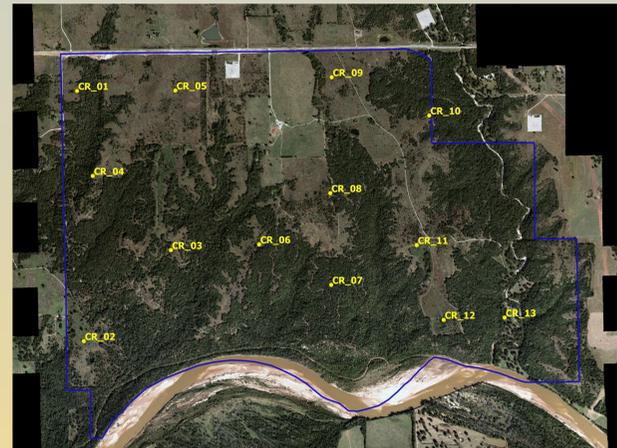
An example of one the models of camera traps used in the collection of observations.

Rationale and Significance

The purpose of this project is to address the viability of different detection collection methods, as well as to test existing software and develop an artificial learning software to detect different vocalization patterns. We can then use this data to generate a database of vocalization, occupancy models, and an image database of coyotes within the two sites.



The Noble Foundation Oswalt Road Ranch property with highlighted points indicating monitor sites.



The Noble Foundation Coffey Ranch Property with highlighted points indicating the location of monitor sites.

Methods

Camera/acoustic data collection

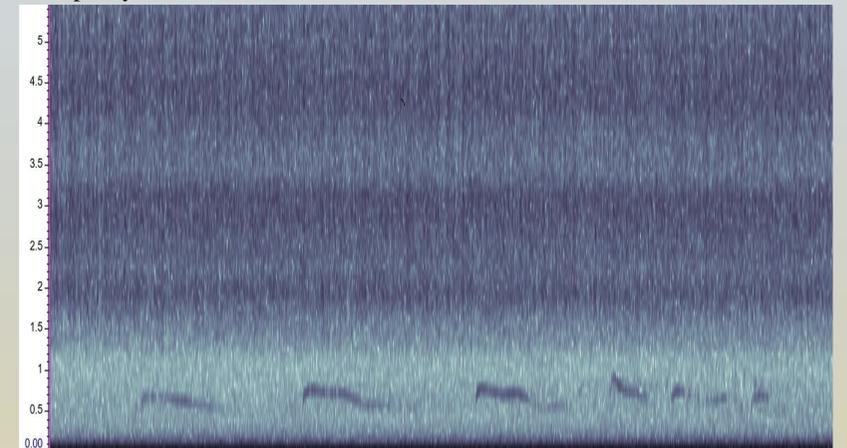
We will be surveying 29 sites (each spaced 1 km apart) across two properties in two separate field seasons consisting of three survey periods each separated by three weeks. For each site, a camera and acoustic monitor will be placed. The acoustic monitors will be set to collect a 1.5-hour period in the evening. Camera traps will be set in a similar fashion and will have a 2-minute delay between pictures to minimize replication of the same visitation.

Study Site

This study will take place at the Noble Foundation Research Institute's Oswalt Road Ranch (ORR; 2,093 ha) and Coffey Ranch (CR; 1,024 ha) properties in Love County, Oklahoma. These properties are 5.3 km apart and are within the Cross Timbers and Prairies ecoregions, which are characterized by a mixture of deciduous forest areas and grassland clearings.

Data Processing

We will be using the commercial programs RAVEN (RAVEN PRO 1.6-Center for Conservation Bioacoustics) to generate spectrograms and develop sample calls to be used in the other programs for detection. These programs will be Kaleidoscope Pro, Python, and R. The Python program will use the base code designed for detection of bobwhite quails (*Colinus virginianus*) modified for the vocalization patterns of coyotes to cut down on analysis time and chance of human error. Similar parameters will be used the R, and Kaleidoscope Pro Software. Then a comparison will be done to determine success of detection and performance. Taking the detections from both collection methods a detection history will be created and PRESENCE (USGS) will be used to model occupancy and detection.



An example of a spectrogram graphs of a coyote howl from RAVEN PRO software.

Expectations

This study will generate databases usable by the Noble Foundation to manage coyotes on the landscape and the development of a program of detection for acoustic monitors that can be used in future soundscape studies addressing biodiversity or prevalence of species.

Deliverables to the Noble Foundation

1. Database of coyote vocalization data collected from the acoustic monitors over the two collection periods.
2. Database of detection from the camera traps will also be generated.
3. Occupancy models of the coyote populations over the two properties that can be used for management purposes and other studies.

Acknowledgement

We would like to thank The Noble Foundation.