# Linking hydrological and habitat variables to anuran occupancy in Arizona wilderness streams

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## Objectives

1.Quantify anuran occupancy with bioacoustics; 2. Relate occupancy to environmental variables at habitat and landscape scales.

**Anurans** = frogs, toads, and treefrogs

## Methods

### Study Design

- 29 recorders deployed March 15 - June 8, 2022
- Recorded 2-hours surrounding sunset and one 5-min interval/hour at night
- Covers gradient of flow regimes

### Environmental Variables

- Overstory cover
- Elevation
- Channel width
- Pool, riffle, run, side channel
- Substrate type
- NDVI

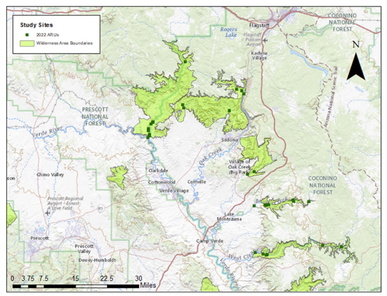


Figure 1. Geographic distribution of the study sites across five Wilderness Areas.

Figure 2. Perennial, ephemeral, and intermittent stream reaches.

### Acoustic Analysis

- Kaleidoscope software (Wildlife Acoustics, Inc.) groups similar calls into “clusters”
- User labels and tunes clusters to create “advanced classifiers,” which detect target species in new datasets

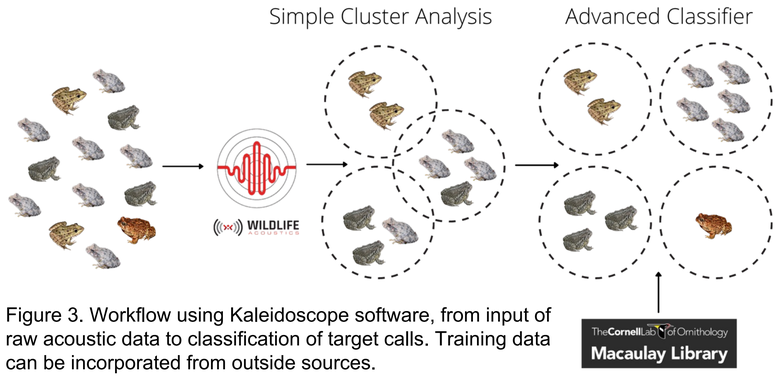


Figure 3. Workflow using Kaleidoscope software, from input of raw acoustic data to classification of target calls. Training data can be incorporated from outside sources.

## Preliminary Results

### Habitat PCA

- Reduced 18 variables to 4 (63% cumulative variance)
- PC1: Dry to wet gradient (flow width and riffle (+))
- PC2: Riparian to upland vegetation (NDVI, canopy cover, elevation (-) and sand, cover heterogeneity (+))

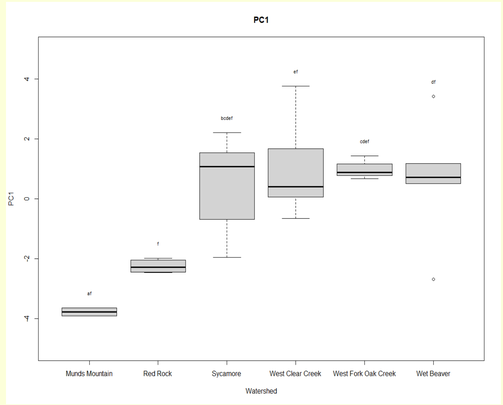


Figure 4. Difference in mean PC1 scores by wilderness streams determined by Tukey Kramer post hoc test. Means that do not significantly differ share a letter.

### Occupancy Modeling

*Hyla arenicolor* occupancy related to null (top model) and to sites with high NDVI, canopy cover, and elevation (PC2)

## Challenges

### Background Noise

- High stream noise at some sites reduces detectability of species by masking calls

### Reducing False Positives

- High rate of false positives returned in classifier results
- Manual review time consuming process

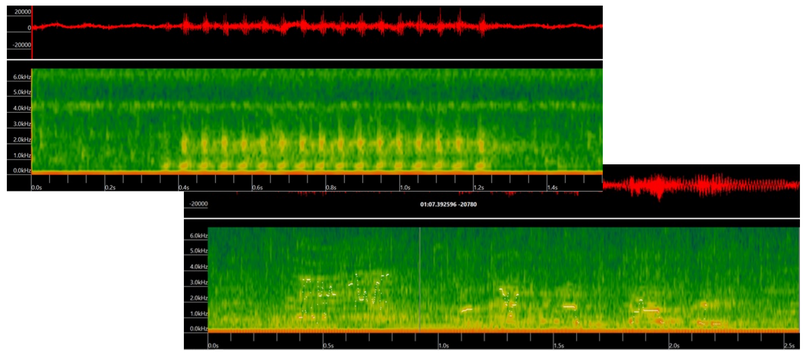

Figure 5. Spectrogram of a *Hyla arenicolor* vocalization (top) versus anthropogenic noise. Similar signals (also see laptop display) can trigger false positives in Kaleidoscope software.

## Implications

- Informing conservation efforts to maintain riparian areas and flows sufficient for supporting anuran populations
- Plotting calling activity temporally will provide insight into peak breeding periods when adequate flows most crucial
- If flows decrease, predict shifts in species assemblages as plant communities change

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