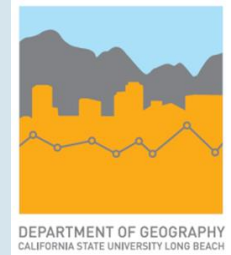


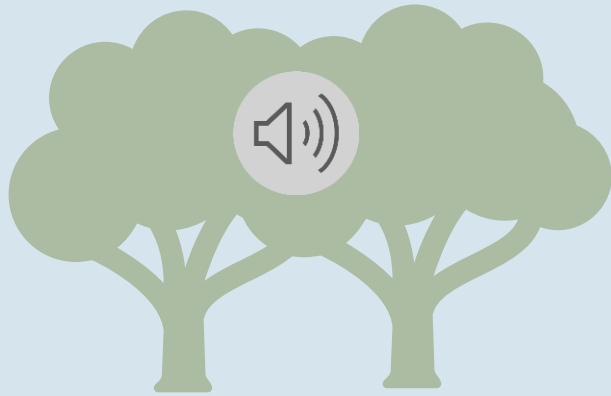
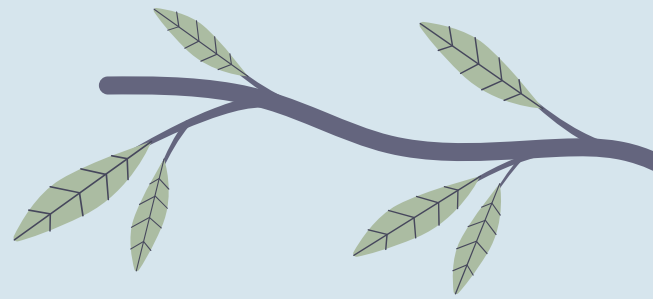
What Makes a Chorus?

The potential of remote sound recording devices to monitor biodiversity and restoration on River Ridge Ranch

By: Andrew Cook, Sophia Ferrero, and Lauren Sims



Listen...

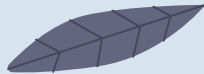


Monoculture

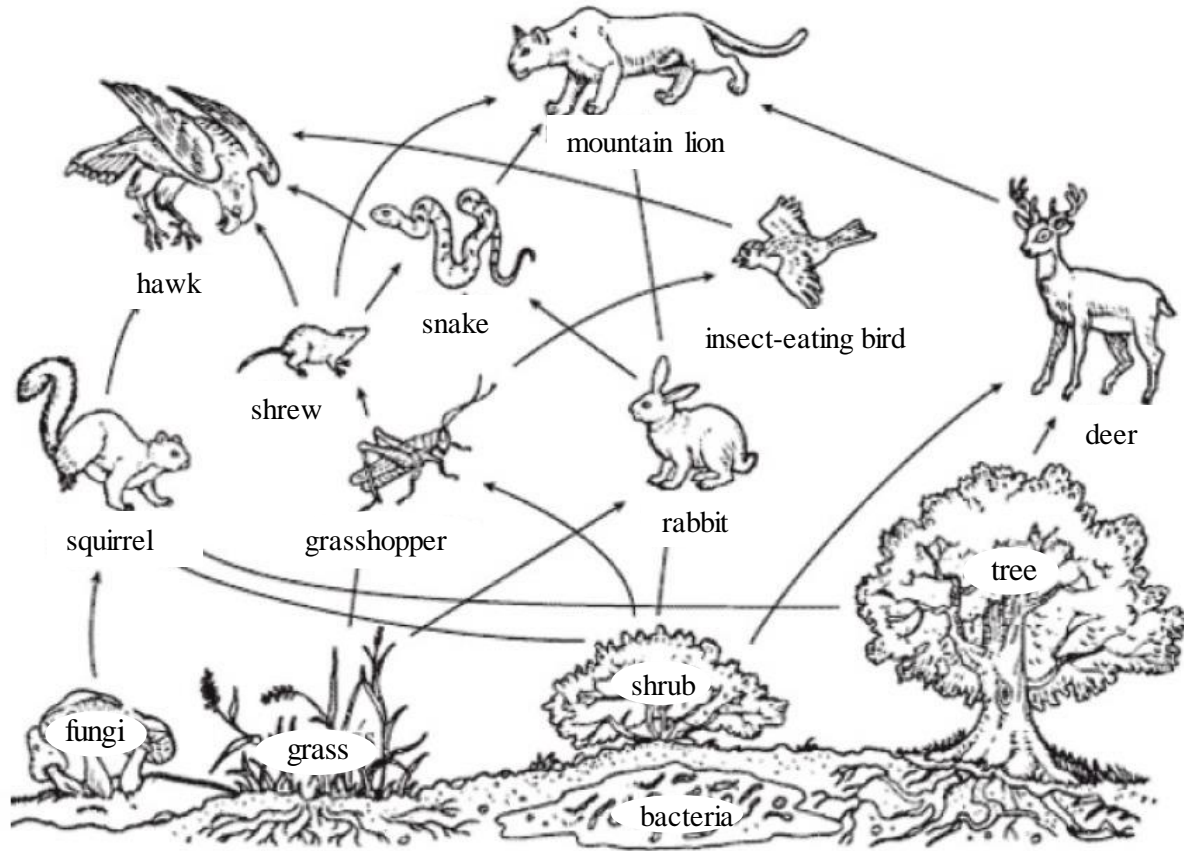


Polyculture

Müller S, Mitesser O, Oschwald L, Scherer-Lorenzen M and Potvin C (2022) Temporal Soundscape Patterns in a Panamanian Tree Diversity Experiment: Polycultures Show an Increase in High Frequency Cover. *Front. Ecol. Evol.* 10:808589.

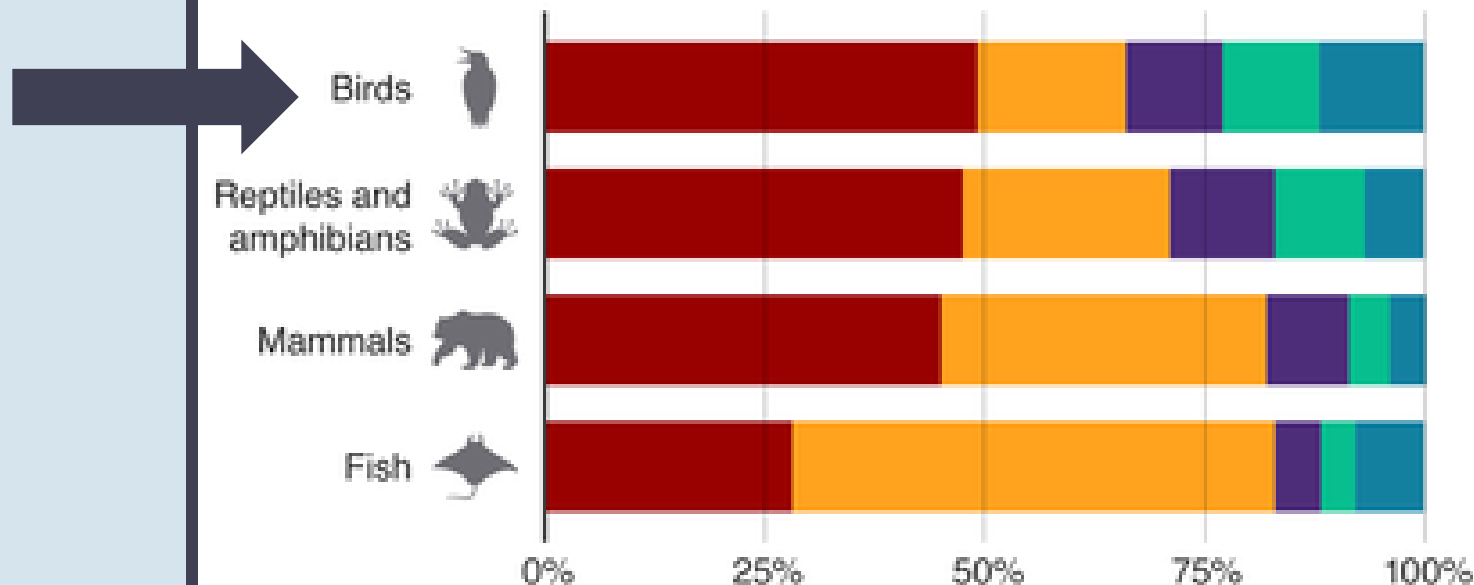


Biodiversity



Habitat loss is a major threat to biodiversity

The Living Planet Report assesses key drivers of species decline



Note: A sample of 3,789 populations evaluated by the Living Planet Index

Carbon Ranching



Bird Houses



How do we Measure Effectiveness?

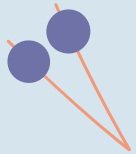
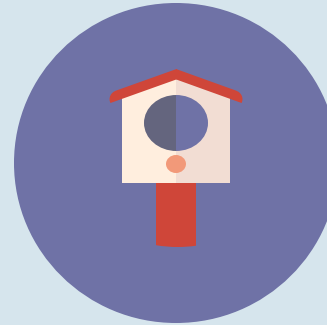
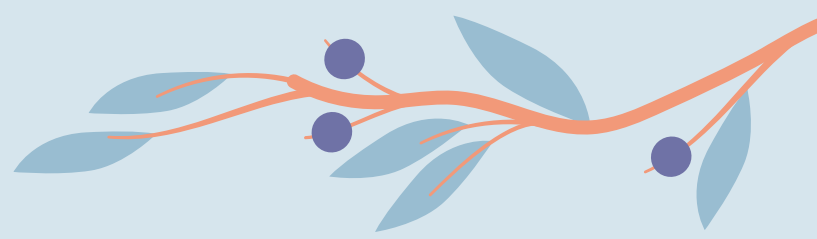


Research Questions

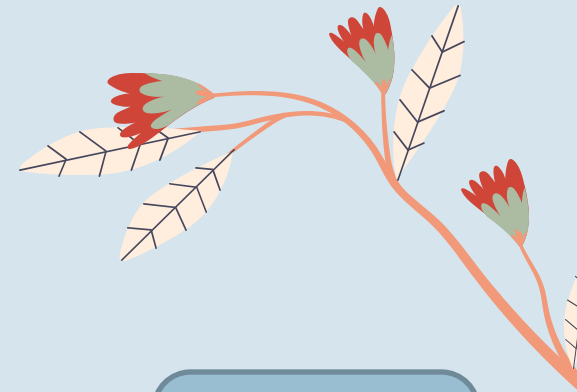
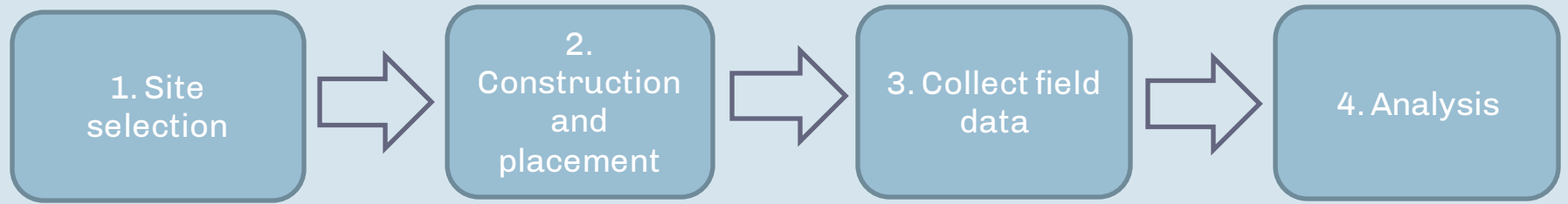


- 1. Can we use sound to estimate biodiversity?**
- 2. Is there a difference in biodiversity between areas in the pasture on the ranch? Time of day?**
- 3. Are there configurable environmental factors in the placement of birdhouses that promote occupancy?**



Objectives



Field Methods



Legend

-  With Camera
-  None

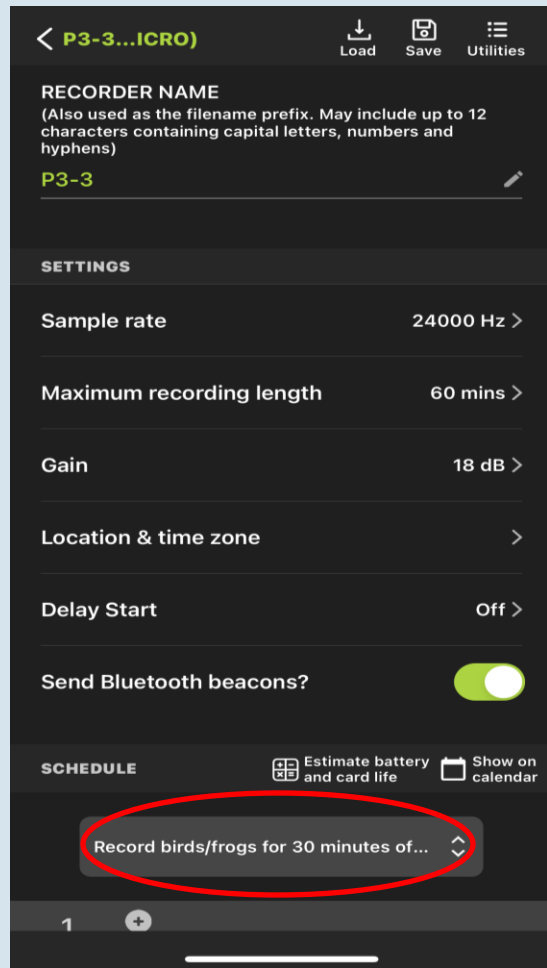


Artificial Perches

Construction and placement

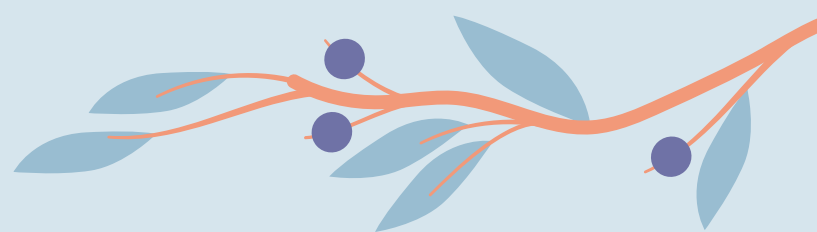


Programming



Data Collection

Acoustic recorders & Cameras

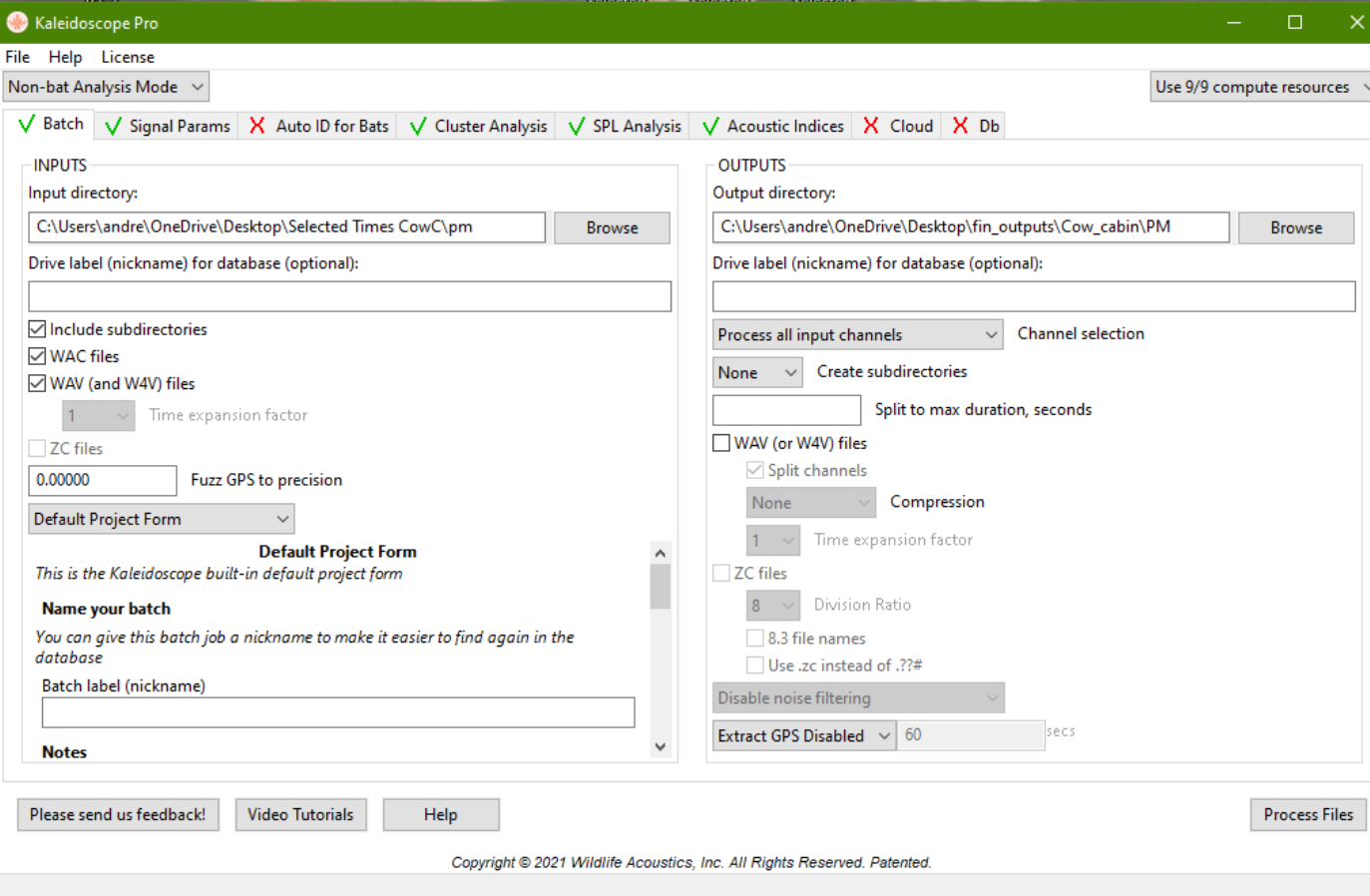


06/19/2022 09:58 71°F SPYPOINT SOLAR



01/08/2018 11:22 PM 86°F SPYPOINT SOLAR

Data Analysis: Kaleidoscope



Kaleidoscope Pro

File Help License

Non-bat Analysis Mode Use 9/9 compute resources

Batch Signal Params Auto ID for Bats Cluster Analysis SPL Analysis Acoustic Indices Cloud Db

INPUTS

Input directory:
C:\Users\andre\OneDrive\Desktop\Selected Times CowC\pm Browse

Drive label (nickname) for database (optional):

Include subdirectories
 WAC files
 WAV (and W4V) files
1 Time expansion factor
 ZC files
0.00000 Fuzz GPS to precision
Default Project Form

Default Project Form
This is the Kaleidoscope built-in default project form

Name your batch
You can give this batch job a nickname to make it easier to find again in the database

Batch label (nickname)

Notes

OUTPUTS

Output directory:
C:\Users\andre\OneDrive\Desktop\fin_outputs\Cow_cabin\PM Browse

Drive label (nickname) for database (optional):

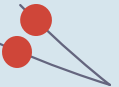
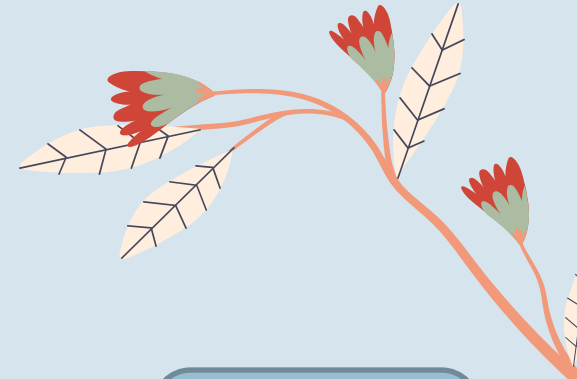
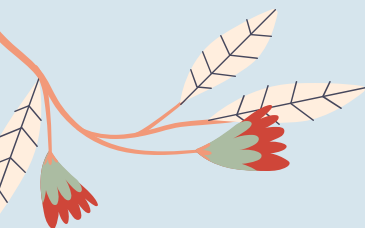
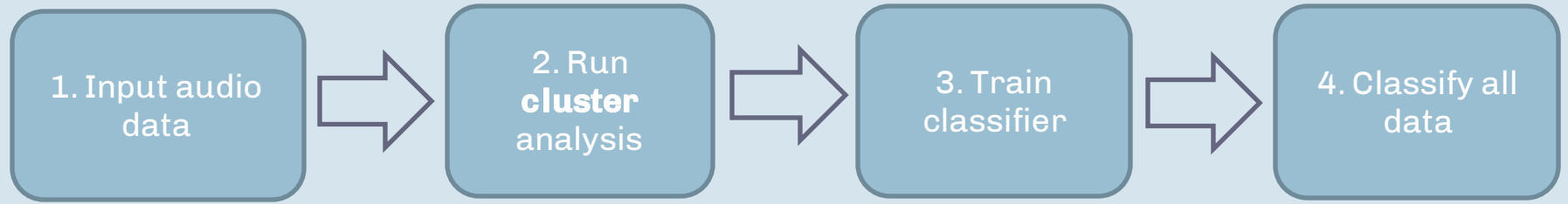
Process all input channels Channel selection
None Create subdirectories
Split to max duration, seconds
 WAV (or W4V) files
 Split channels
None Compression
1 Time expansion factor
 ZC files
8 Division Ratio
 8.3 file names
 Use .zc instead of .??#
Disable noise filtering
Extract GPS Disabled 60 secs

Please send us feedback! Video Tutorials Help Process Files

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Audio Analysis

Work Flow



Cluster Analysis

present_in\COW-CABIN_20220617_060000.wav @718.25261s (1.878667s)

File Help

11.0kHz
10.0kHz
9.0kHz
8.0kHz
7.0kHz
6.0kHz
5.0kHz
4.0kHz
3.0kHz
2.0kHz
1.0kHz
0.0kHz

0.0s 0.2s 0.4s 0.6s 0.8s 1.0s

Prefix: COW-CABIN Model: Song Meter Micro SMM05194 2.9 Timestamp: 2022-06-17 06:00:00-7:00 GPS: WGS84 36.15938 N 118.79996 W

Notes

GIANDONVersion:1.0

Common Raven	Common Starling	Tree Swallow	Northern Rough-winged		
Turkey	Western Kingbird	Northern Mockingbird	Nuttall's Woodpecker		
House Finch	Ash-throated Flycatcher	Oak Titmouse	House Wren		
Lesser Goldfinch	California Scrub-Jay	Red-winged Blackbird	Bullock's Oriole		

11:58:251

C:\Users\andre\OneDrive\Desktop\presen... File Help

FOLDER	IN FILE
407	COW-CABIN_20220617_060000.wav
408	P2-3_20220616_050000.wav
409	COW-CABIN_20220617_060000.wav
410	COW-CABIN_20220617_060000.wav
411	COW-CABIN_20220617_060000.wav
412	P2-3_20220616_050000.wav
413	COW-CABIN_20220617_060000.wav
414	COW-CABIN_20220617_060000.wav
415	COW-CABIN_20220617_060000.wav
416	COW-CABIN_20220617_060000.wav
417	P2-3_20220616_050000.wav
418	COW-CABIN_20220617_060000.wav
419	COW-CABIN_20220617_060000.wav
420	COW-CABIN_20220617_060000.wav
421	P2-3_20220616_050000.wav
422	COW-CABIN_20220617_060000.wav
423	COW-CABIN_20220617_060000.wav
424	COW-CABIN_20220617_060000.wav
425	COW-CABIN_20220617_060000.wav
426	COW-CABIN_20220617_060000.wav
427	COW-CABIN_20220617_060000.wav
428	COW-CABIN_20220617_060000.wav
429	COW-CABIN_20220617_060000.wav
430	COW-CABIN_20220617_060000.wav
431	COW-CABIN_20220617_060000.wav
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448	COW-CABIN_20220617_060000.wav
449	COW-CABIN_20220617_060000.wav
450	COW-CABIN_20220617_060000.wav
451	COW-CABIN_20220617_060000.wav
452	COW-CABIN_20220617_060000.wav

Identification

cluster.3

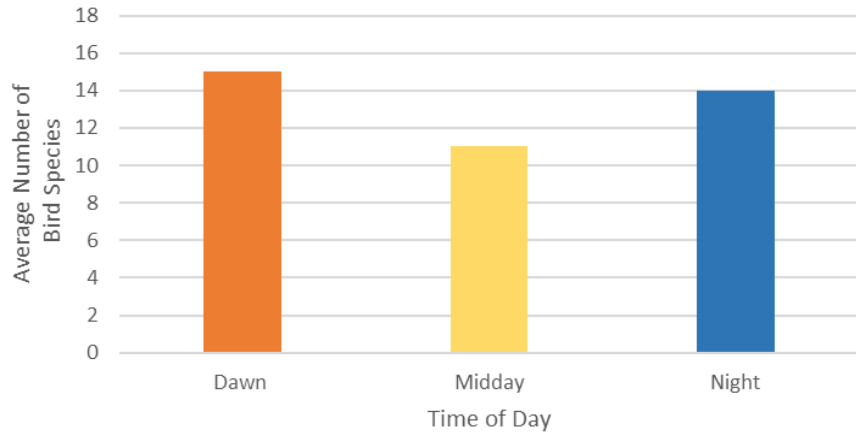
cluster.3 Rename Noise

Auto next file

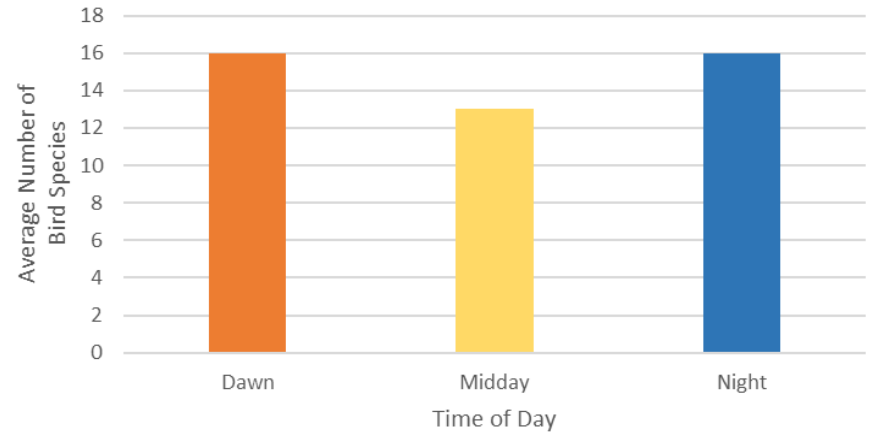
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410		COW-CABIN_20220617_060000.wav	0	118.501335	1.626667	cluster.2	1.261056	cluster.2
411		COW-CABIN_20220617_060000.wav	0	106.223999	0.976000	cluster.2	1.263911	cluster.2
412		P2-3_20220616_050000.wav	0	222.074661	2.640000	cluster.2	1.267057	cluster.2
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414		COW-CABIN_20220617_060000.wav	0	180.832001	0.192000	cluster.2	1.273840	cluster.2
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416		COW-CABIN_20220617_060000.wav	0	302.399994	0.154667	cluster.2	1.301854	cluster.2
417		P2-3_20220616_050000.wav	0	1601.429321	0.661333	cluster.2	1.307699	cluster.2
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421		P2-3_20220616_050000.wav	0	724.117310	7.605333	cluster.2	1.330896	cluster.2
422		COW-CABIN_20220617_060000.wav	0	718.602661	1.178667	cluster.3	0.164230	cluster.3
423		COW-CABIN_20220617_060000.wav	0	713.247986	1.274667	cluster.3	0.231511	cluster.3
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425		COW-CABIN_20220617_060000.wav	0	1549.493286	0.378667	cluster.3	0.278468	cluster.3
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Findings

Average Number of Bird Species Inside Copses

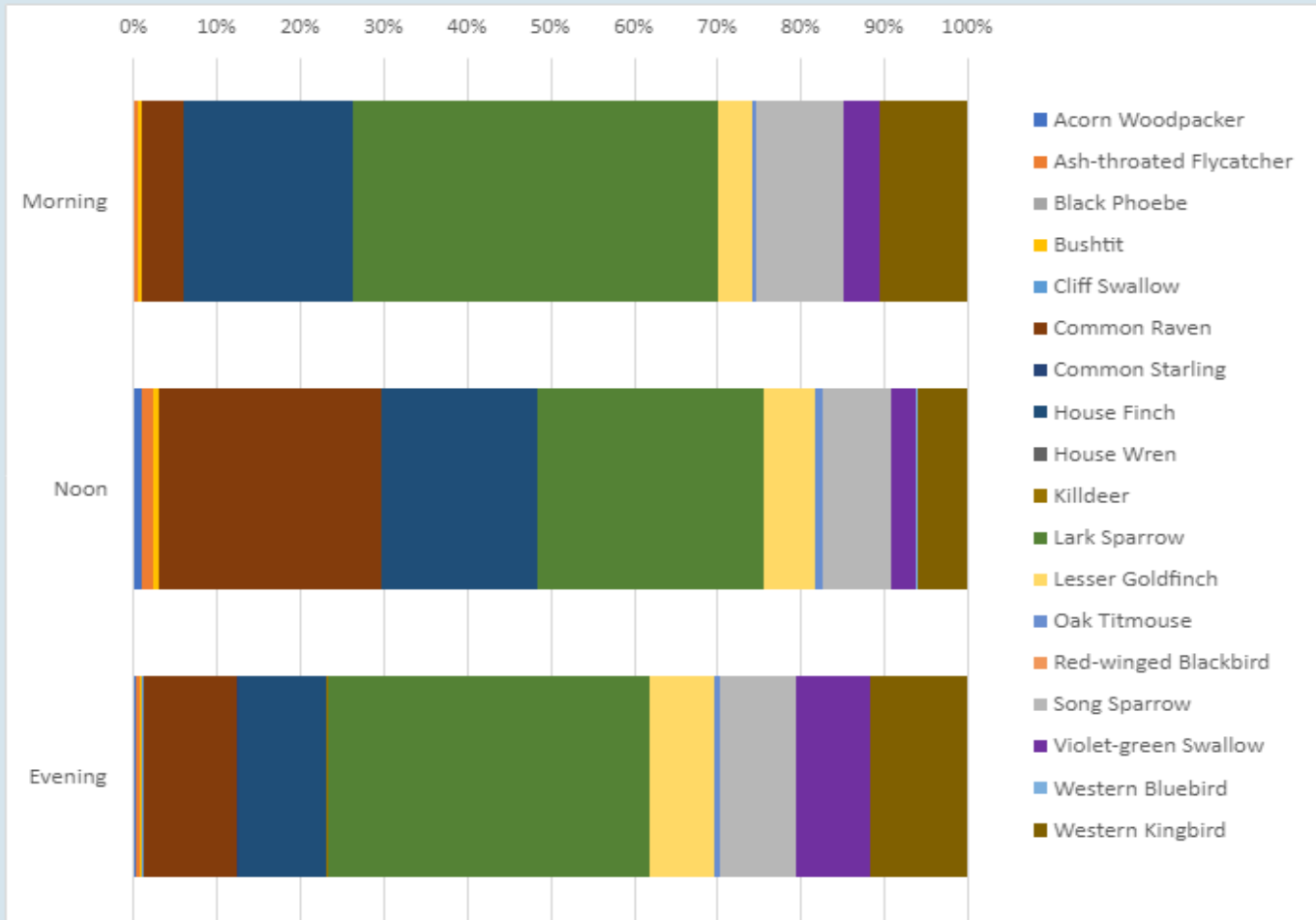


Average Number of Bird Species in Open Pastures

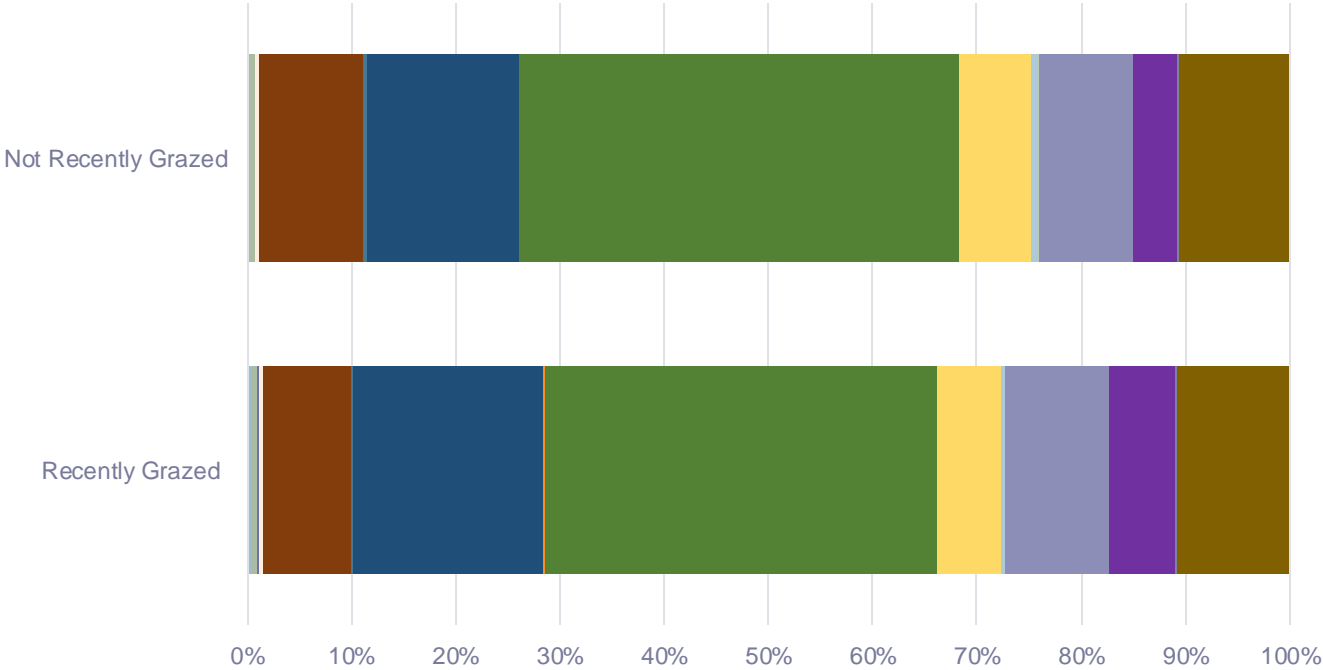


- **Dawn:** 4:00 a.m. - 6:00 a.m.
- **Midday:** 12:00 p.m. - 1:00 p.m.
- **Night:** 7:00 p.m. - 9:00 p.m.

Bird Calls & Time of Day



Bird Calls & Grazing

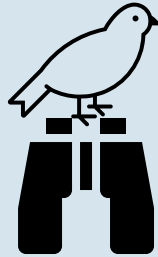
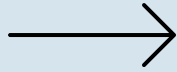


- Acorn Woodpcker
- Ash-throated Flycatcher
- Black Phoebe
- Bushtit
- Cliff Swallow
- Common Raven
- Common Starling
- House Finch
- House Wren
- Killdeer
- Lark Sparrow
- Lesser Goldfinch
- Oak Titmouse
- Red-winged Blackbird
- Song Sparrow
- Violet-green Swallow
- Western Bluebird
- Western Kingbird

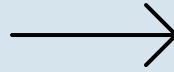
Method Comparison



6



8



18



Occupancy of Bird Houses

- Aspect
- Color
- Neighbors





Conclusions

- **Audio-box Potential**
- **Bird Species Distribution**
- **Bird House Occupancy**

Future Research

- Seed trap survey
- Different seasons and placements?
- More time to teach classifier
 - ~70% accuracy



Acknowledgements

- Thank you so much to Gary for being such a gracious host here on the ranch and allowing us to use the land for our study
- To Paul and Scott for your guidance and teaching
- Extra special thanks to Mystyn for all of your knowledge, time, and guidance throughout our study

