Using Automated Acoustic Recorders to Uncover Patterns of Avian Presence in a Sequoia Forest

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Giant sequoia forests support a complex ecosystem with unique habitats highly influenced by fire. In 2015, the Rough Fire burned 151, 623 acres of land, including areas within Sequoia and Kings Canyon National Parks. We deployed acoustic monitoring systems to understand how the avian community responded to different fire types. In addition, we had the unique opportunity to place recorders in the canopy and at ground level on an individual sequoia tree to examine differences in acoustic structure along a vertical gradient.

Objectives

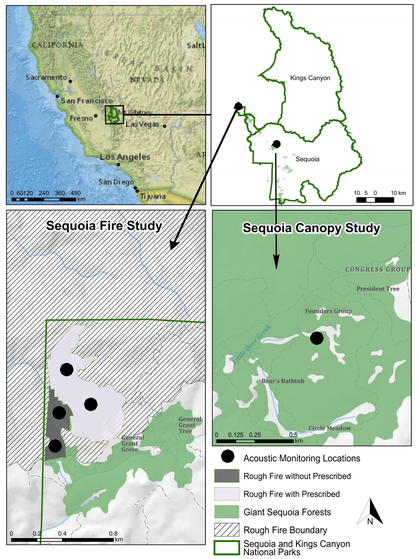
1. Understand how wildfire severity changes the avian community
2. Examine differences in avian community composition along a vertical gradient in a sequoia tree

Methods

-Deployed song meters (*SM3 Wildlife Acoustics*) at 6 monitoring sites

-Recorded acoustic data:
Fire Study- 4 hrs around sunrise/ 1.5 hrs sunset

Tree Study- 1.5 hrs around sunrise/sunset



Rough without prescribed fire

Rough with prescribed fire

canopy

Sequoia Fire Study
- Rough with prescribed fire
- Rough without prescribed fire

Sequoia Tree Study
- Canopy
- Ground

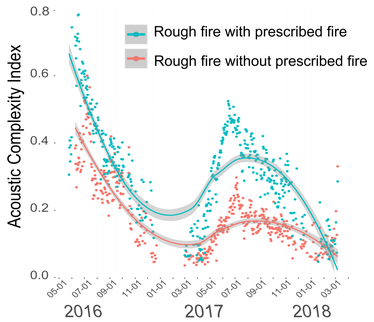
Acoustic complexity Index (ACI)
- Acoustic data calibrated and converted to 1s 1/3 octave band sound pressure levels (SPL)
- ACI calculated with custom scripts in R every 10 minutes from 1.6-8kHz *(Pieretti & Morri, 2011)*
- Mean daily ACI presented

Avian call diversity
- Subsampled 58 files
- Manually identified bird calls in 10 min samples with Raven Pro 1.5. *(Cornell University)*
- Summarized diversity of 10 min samples using R software *(vegan package)*

Sequoia Fire Study

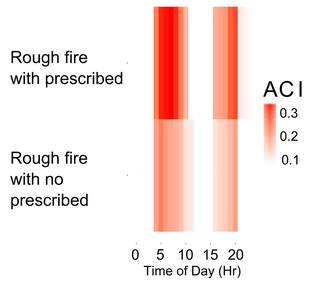
Patterns in bioacoustic activity

Seasonal



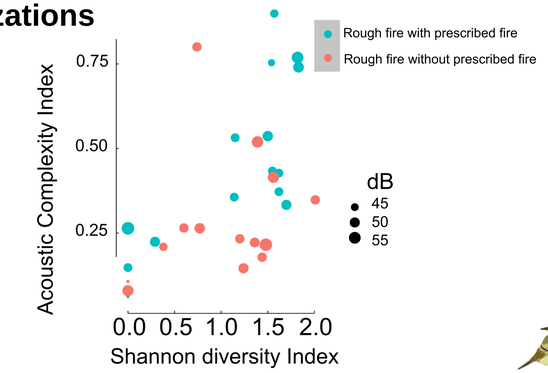
Higher for sites with prescribed fire before the Rough Fire.

Diel



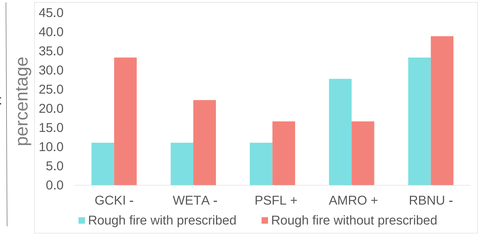
Higher activity continued at sites with prescribed fire.

Relationship between ACI and diversity of vocalizations



Avian community response to severity of fire

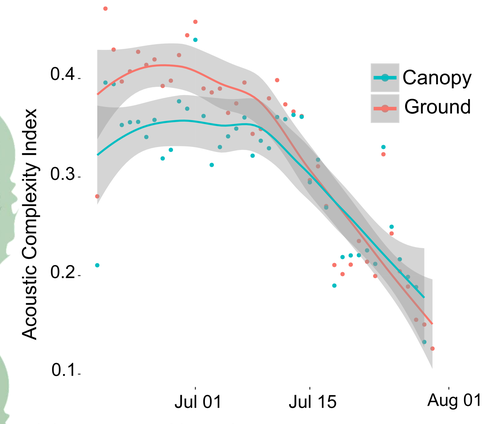
Code	Fire	Species
HAFL	+	Hammond's flycatcher
BRCR	+	Brown creeper
AMRO	+	American robin
GCKI	–	Golden-crowned kinglet
WETA	–	Western tanager
YRWA		Yellow-rumped warbler
DEJU		Dark-eyed junco
WIWA		Wilson's warbler



Sequoia Tree Study

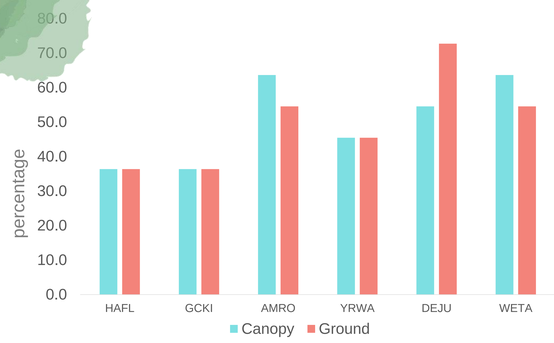
~85m

Patterns in bioacoustic activity



Higher at ground in early summer.
Difference decreases over season.

Differences in avian community



Similar detection rates between canopy and ground.
Western Tanager showed the greatest difference.

Conclusion

We present preliminary evidence that prescribed fire abates the ecological effects of wildfires *and* a novel comparison of avian acoustic diversity along a vertical gradient within a Giant Sequoia.

Future Work

- Standardize the use of acoustic monitoring data in park management
- Develop automated detectors for specific species of interest to reveal finer temporal scale patterns in species presence and response to fire
- Use sounds collected in outreach products. ***For more on this see talk by Dr. Jacob Job Sat. April 14 @ 4 pm in Coronado II***

References

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Acknowledgments

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