First-Year Responses of Forest Bats & Their Arthropod Prey to Prescribed Fire During the Swarming Period at Mammoth Cave National Park

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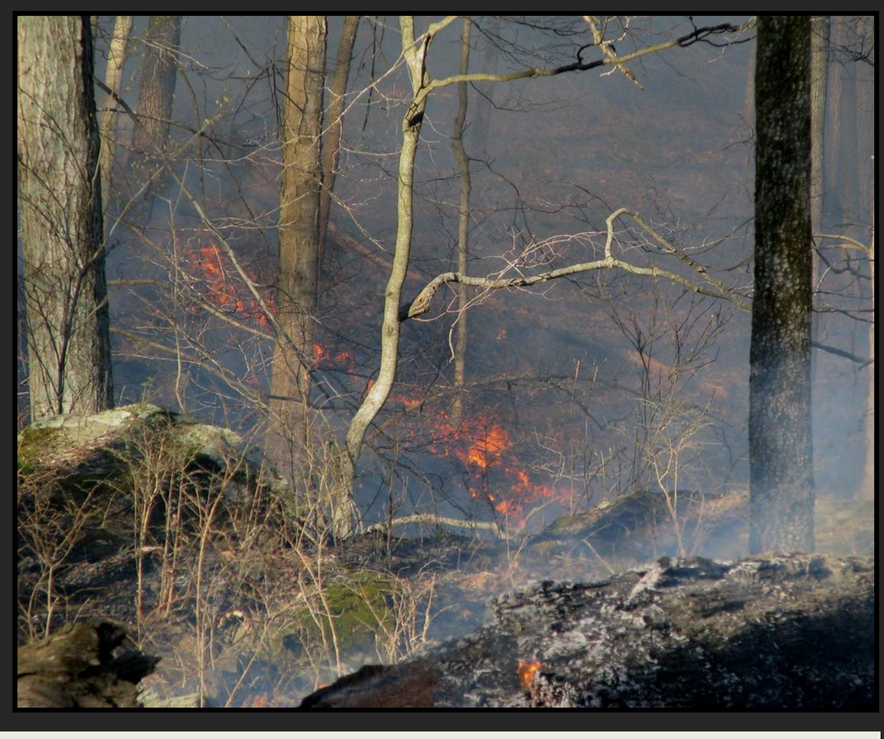
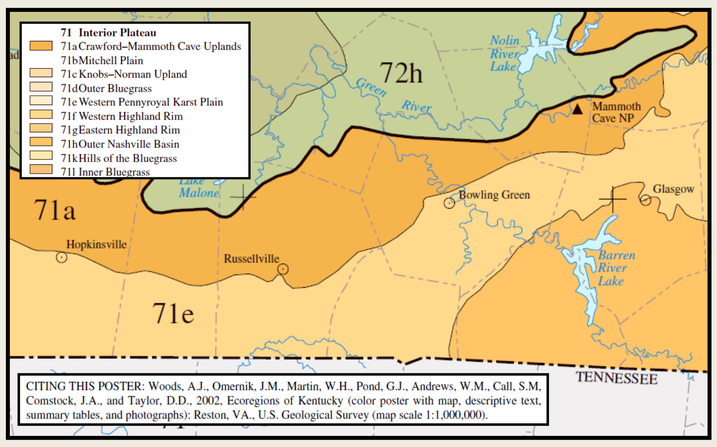


Introduction

Prescribed fires in the mixed-oak forests of eastern North America are hypothesized to have positive effects on foraging & roosting habitat that may outweigh the risks to forest bats from smoke and heat exposures during fires. Our ongoing project focuses on testing hypotheses about the relationships between effects of fire on insect prey availability & canopy structure & the relationship to selection of foraging areas by bats during the swarming & staging periods at Mammoth Cave National Park.

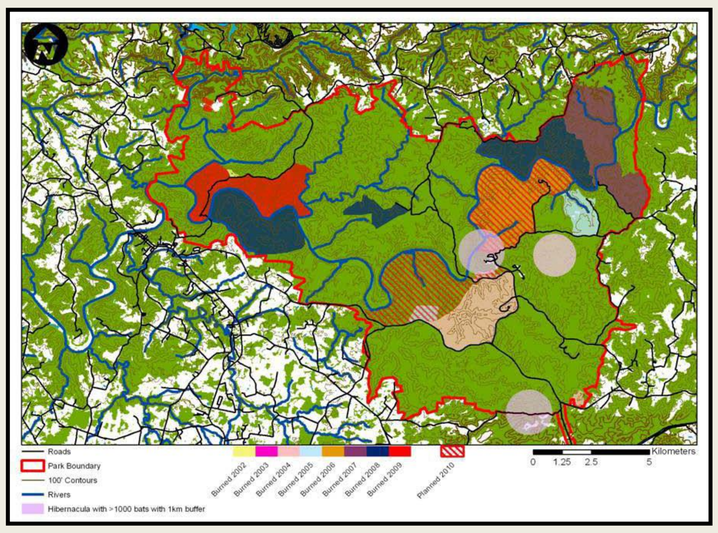
Methods

- We monitored bat activity & insect occurrence concurrently in paired **burned** & **unburned** land parcels from August-October 2010. Burns were implemented the previous April.



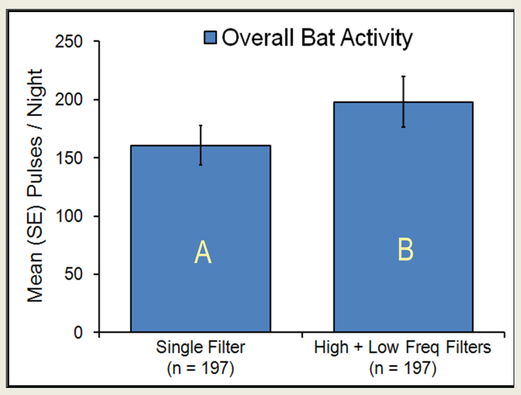
Field Work

- Repeated surveys were conducted along **stratified random transects.**
  - Bat activity assessed with **acoustic surveys** (Anabat II); 18 surveys spanned 56 nights.
  - Insect occurrence assessed with **blacklight traps** on 9 nights.



Analysis of Bat Activity

- Acoustic data processed with Analook (v. 4.8j) using **custom filters** to isolate: 1) all echolocation calls, 2) high freq. calls, & 3) low freq. calls.
  - *Preliminary methods comparison.* Assessed differences in indices of overall activity (**single filter** vs. **high + low freq. filters**).
  - Paired t-test significant ($t_{196} = 5.33$, $P \leq 0.05$).
  - More conservative estimate of activity (**single filter**) used in subsequent analysis
  - *Spatial & temporal effects.* ANOVAs with **burn** & **sampling round** (early, mid, late) as main effects; Tukey's HSD to separate means.



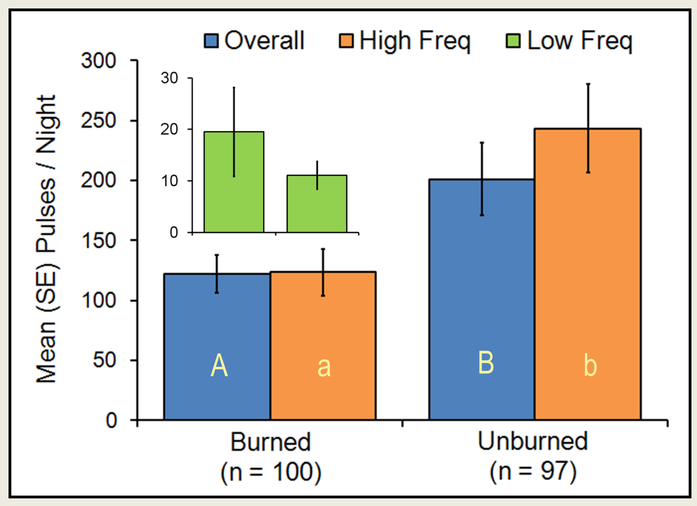
Analysis of Insect Occurrence

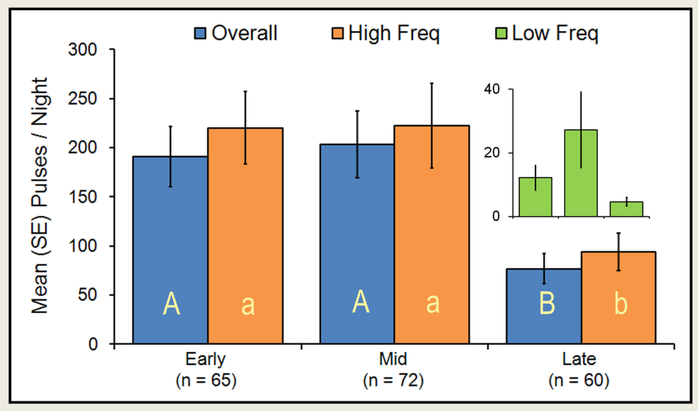
- Insects sorted & identified to order. **Coleoptera**, **Diptera**, & **Lepidoptera** counted, as well as **total insects** / trap.
- *Spatial & temporal effects.* ANOVAs with **burn** & **sampling round** (early, mid, late) as main effects; Tukey's HSD to separate means.

Results & Discussion

Bat Activity

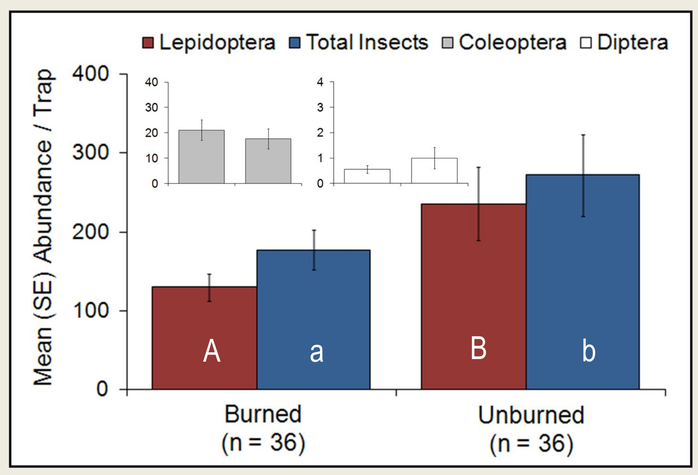
- Significant models ($P \leq 0.05$)
  - Overall pulses / night ($F_{5,191} = 3.58$)
  - High freq. pulses / night ($F_{5,191} = 3.49$)
- Non-significant model ($P > 0.05$)
  - Low freq. pulses / night ($F_{5,191} = 2.31$)
- Bat activity was higher in unburned parcels; high frequency activity likely reflects habitat use by "clutter-adapted" *Myotis*.
- Activity decreased in the late sampling round (28 Sept. – 7 Oct.) as hibernation approached.

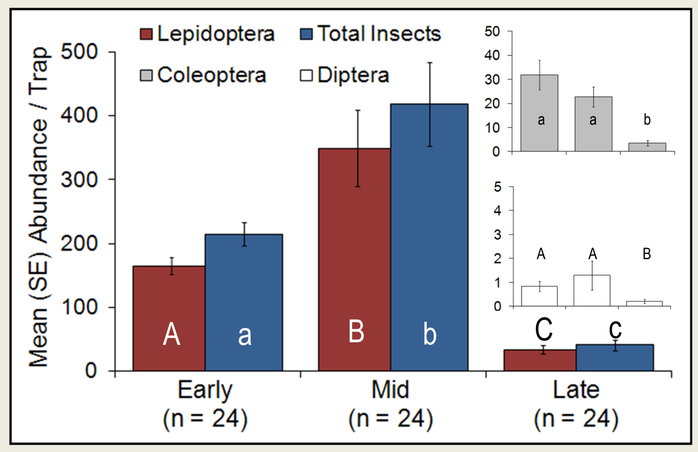




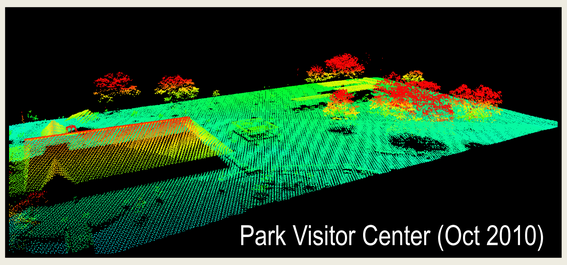
Insect Occurrence

- All models significant ($P \leq 0.05$)
  - Total insects / trap ($F_{5,66} = 38.0$)
  - Coleoptera / trap ($F_{5,66} = 11.2$)
  - Diptera / trap ($F_{5,66} = 3.1$)
  - Lepidoptera / trap ($F_{5,66} = 39.5$)
- The bulk of insects captured (= Lepidoptera) were more abundant in unburned parcels; likely due to live host plant resources.
- The lack of burn effect for Coleoptera and Diptera was unexpected, though other data from malaise & funnel traps may explain this.
- Declining insect abundance during late sampling round suggests prey may be at a premium as hibernation for bats approaches.





Future Work



We will continue to provide a stronger scientific basis for fire management as we build a more robust data set that spans a wider window of time post-burn. LIDAR mapping of forest canopy structure will be integrated with predator & prey data to more fully understand the interrelated impacts of clutter and prey occurrence on predator activity patterns.

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