FIRE EFFECTS ON CHAPARRAL-ASSOCIATED MAMMALS

PROGRESS ON A MULTI-YEAR STUDY FOLLOWING THE CEDAR FIRE

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San Diego County Mammal Atlas

Funded by USDA/USDI Joint Fire Science Program

Short-term Fire Impacts on Mammals

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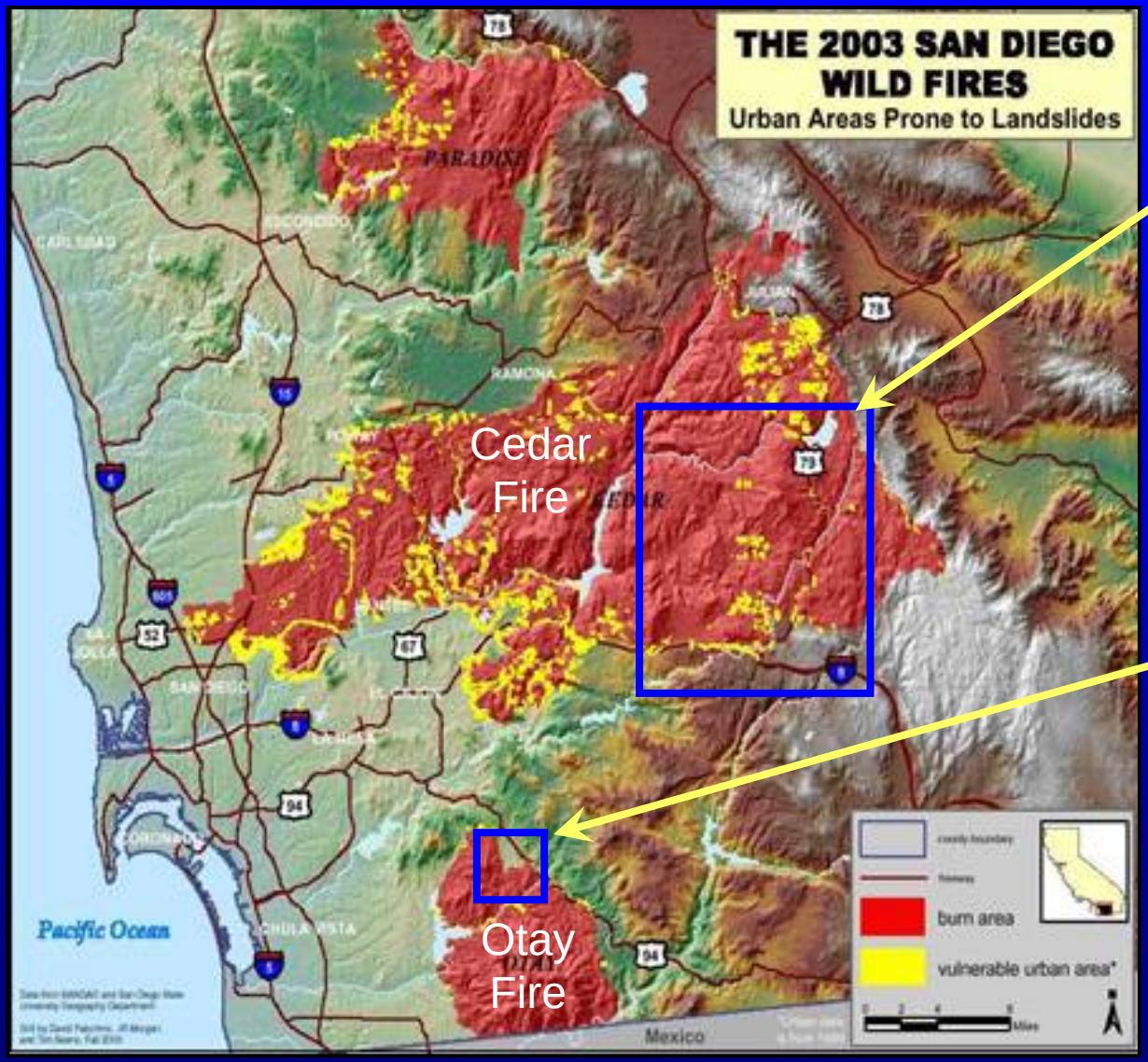
Study Goals: Longer-term fire effects

Following the largest wildfire event in recent California history:

- Track changes in
  - Community composition
  - Species' distribution
  - Species' abundance
- For chaparral-associated mammals:
  - Rodents
  - Bats
  - Carnivores
- As functions of
  - Fire severity
  - Distance from unburned edge
  - Time since fire

Inform fuels management efforts in a hotspot of biological diversity.

Study Area



Primary Study Area

- Community patterns (rodents, bats, and carnivores)
- Burned and unburned chaparral at 3,000-3,500 ft elevation
- From the heart of the Cedar Fire to outside its southern perimeter

Secondary Study Area

- Rodent demography
- Burned and unburned coastal sage scrub.
- Pre- and post-burn capture-recapture data

Methods - Rodents

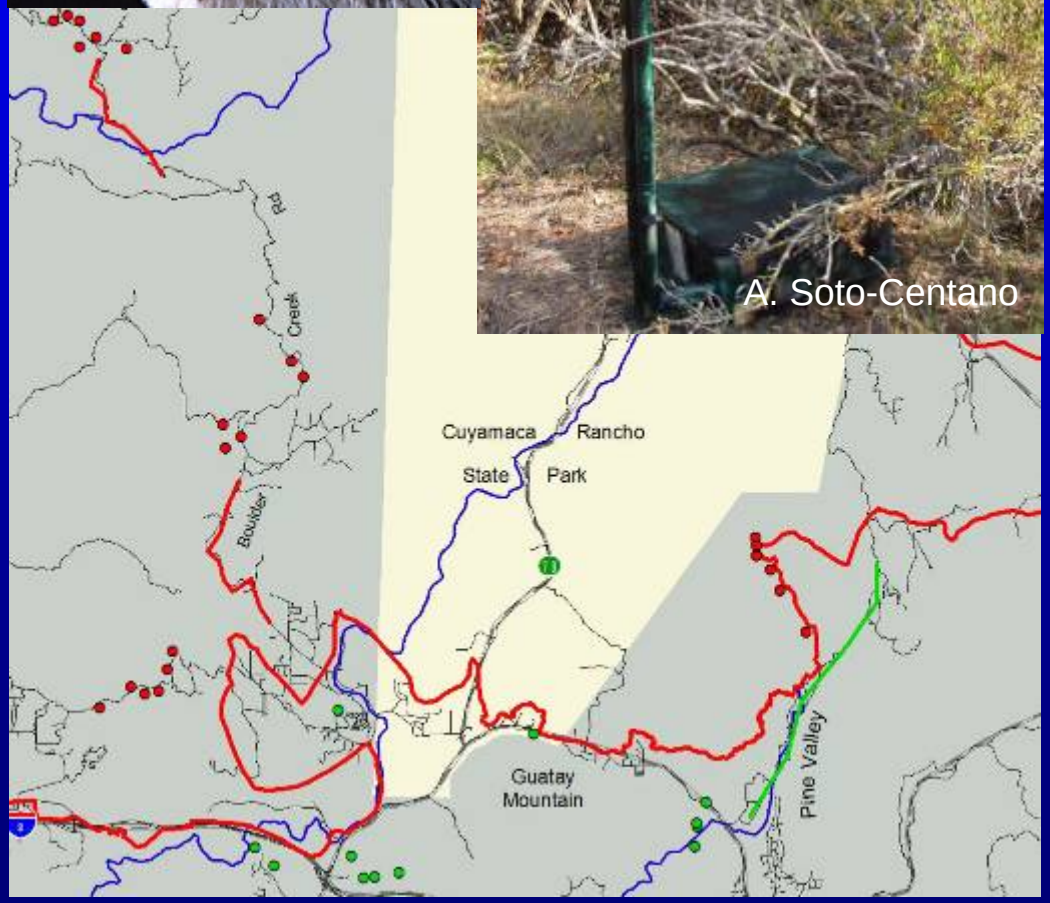
- Repeated-measures sampling design based on occupancy methods of MacKenzie et al. (2002, 2003)
- 40 study plots:
  - 30 burned
    - Ranging from burn edge to ~8 km into burn interior
    - Covering range of burn severities
  - 10 unburned
- 30 Sherman live traps per plot
- Sampled spring and fall for 5 consecutive nights

Methods – Bats

- 36 passive ultrasonic monitoring stations
  - 12 unburned
  - 12 burn edge
  - 12 burn interior
- Sampled each summer for 3 nights each
- 3 roving survey transects
  - Unburned
  - Burn edge
  - Burn interior

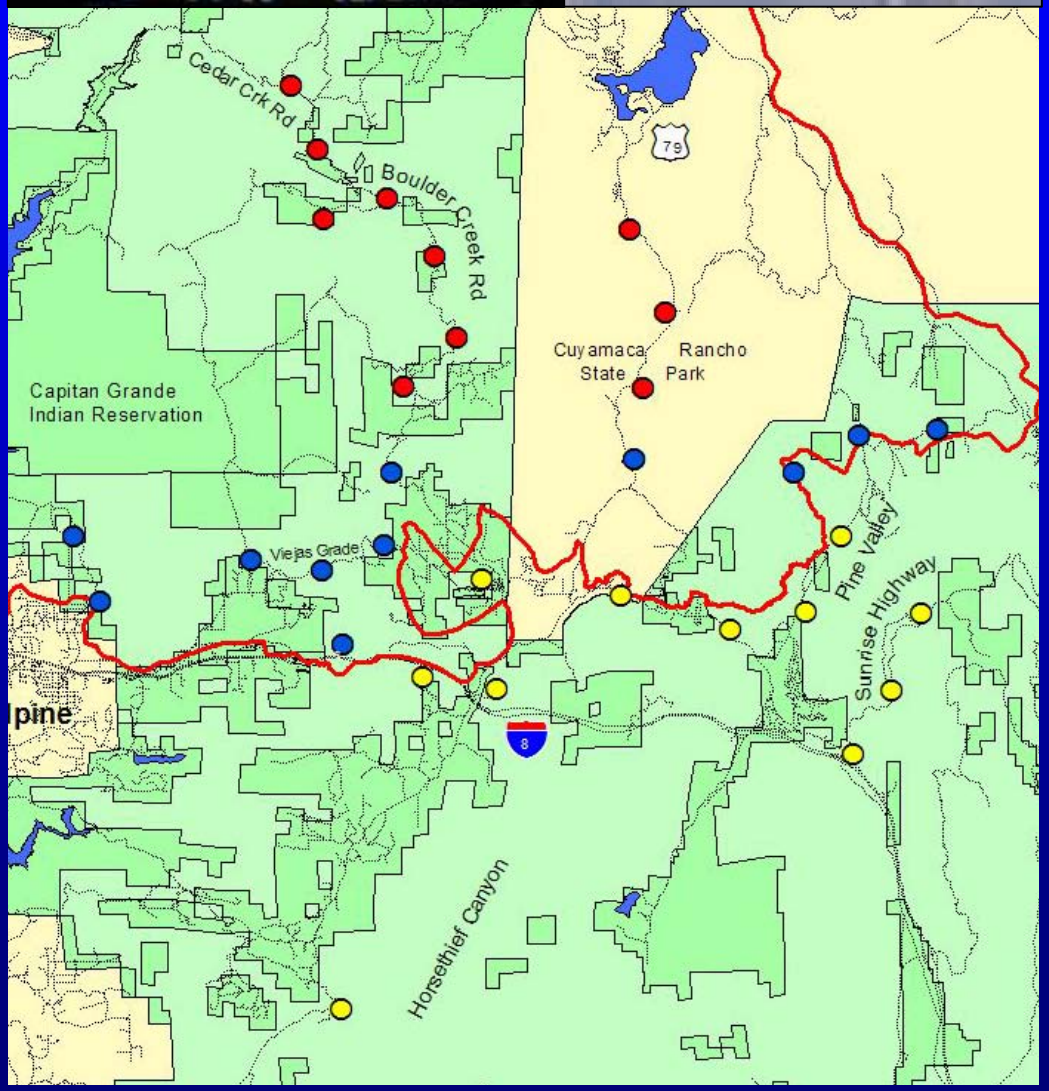
M. Tuttle

A. Soto-Centano



Methods - Carnivores

- Game-Vu camera stations & gypsum track stations
  - 11 Unburned
  - 11 Burn edge
  - 10 Burn interior
- Sampled 3 times per year (winter, spring, fall) for 8 consecutive nights each



Methods – Vegetation and Other Environmental Variables

- Annual vegetation sampling:
  - 100 point intercepts per plot
  - 20 1-m^2 quadrats per plot
- Plant cover and height by species and growth form
- Percent ground cover by litter, duff, cryptobiotic crust, etc.
- Burn severity index using shrub skeleton diameters (Keeley 1998)
  - 40 shrub skeletons/plot
- Distance to “fire refugia”
- Soil characteristics

J. Duggan

W. Spencer

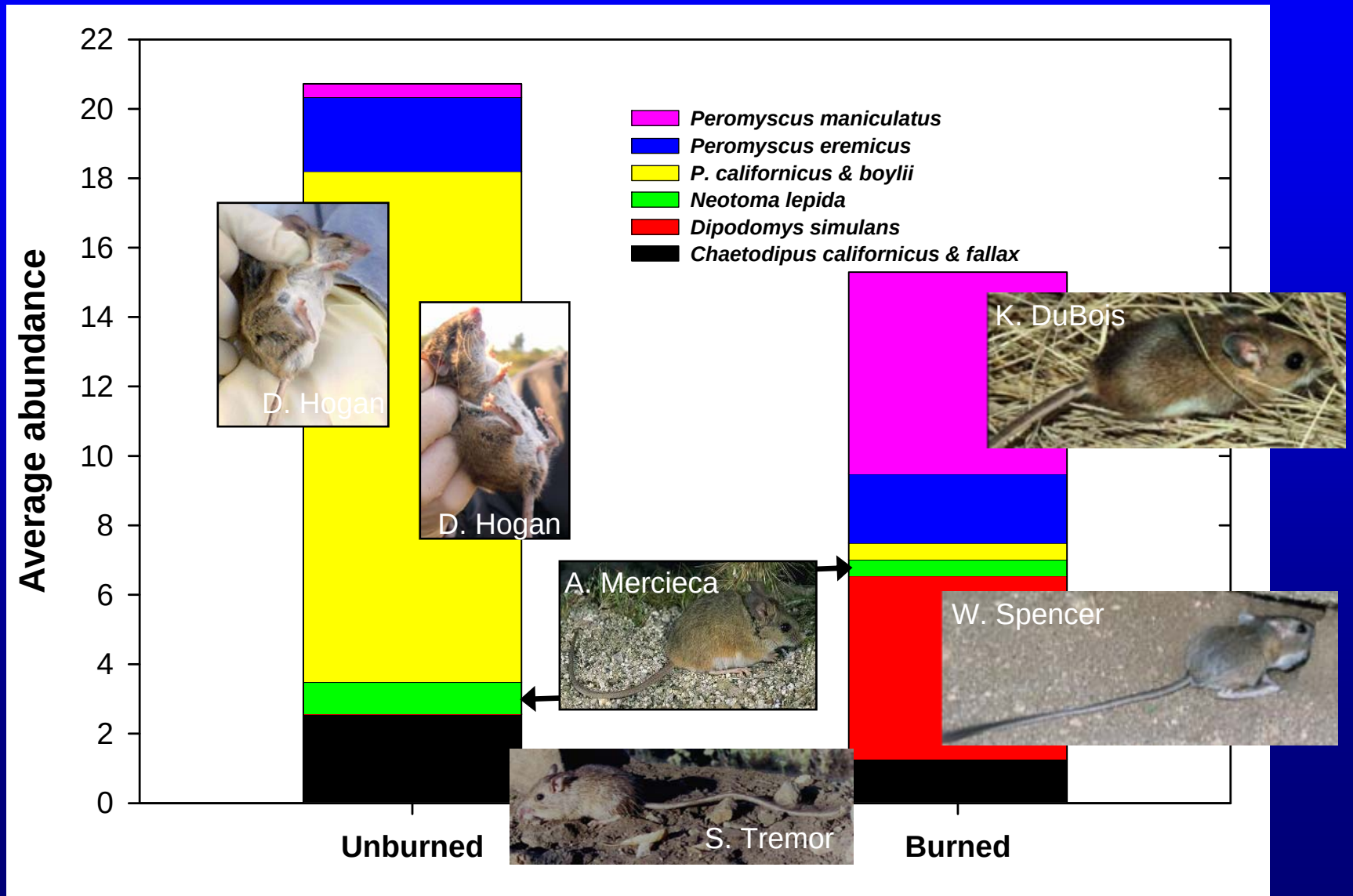
W. Spencer

Methods - Analyses

- Today:
  - Focus on rodent data, using two measures at each site:
    - Species presence (occupancy)
    - Species abundance (# unique captures)
  - Use hierarchical linear modeling (HLM & HGLM) to explore trends.
    - Regression-style, repeated measures techniques
    - Use burn severity and distance from unburned edge as covariates
- Eventually:
  - More complete analyses on all taxa
  - Use occupancy modeling techniques that control for differential detection rates
  - Increased use of multivariate techniques

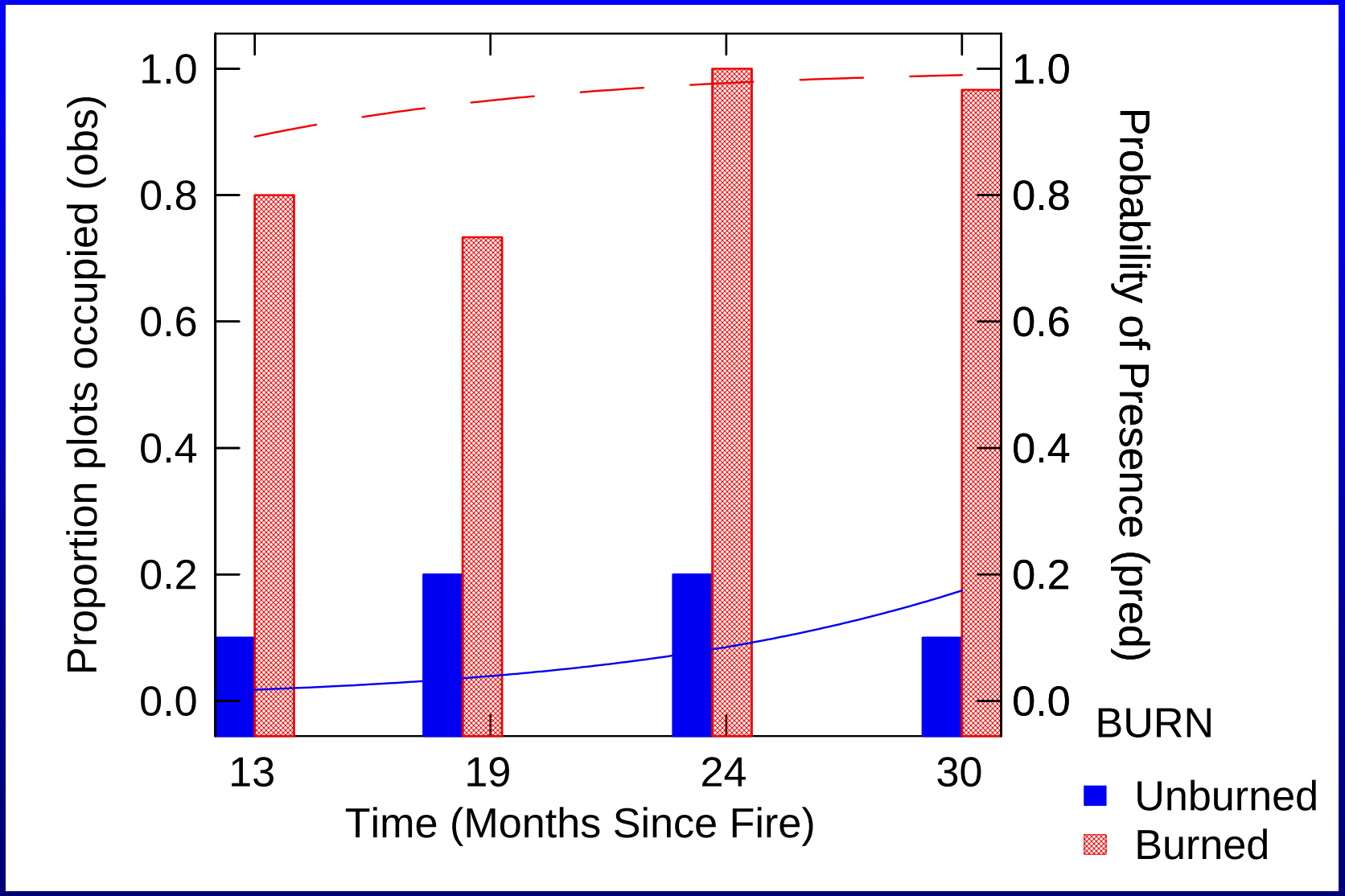
Results - Rodents

- Community Composition Varies with Burn Status



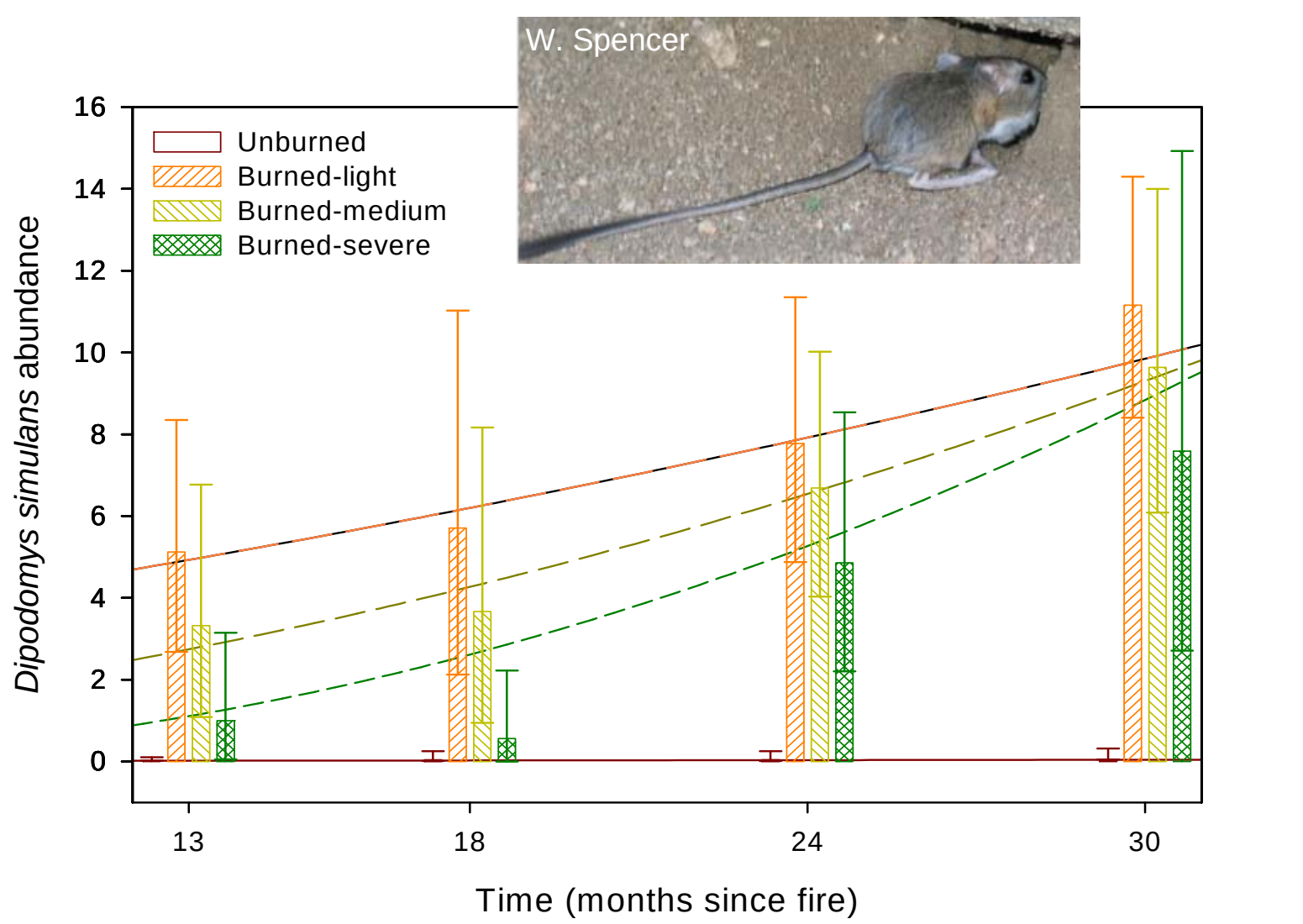
Dulzura Kangaroo Rats

Consistently more common on burned areas.



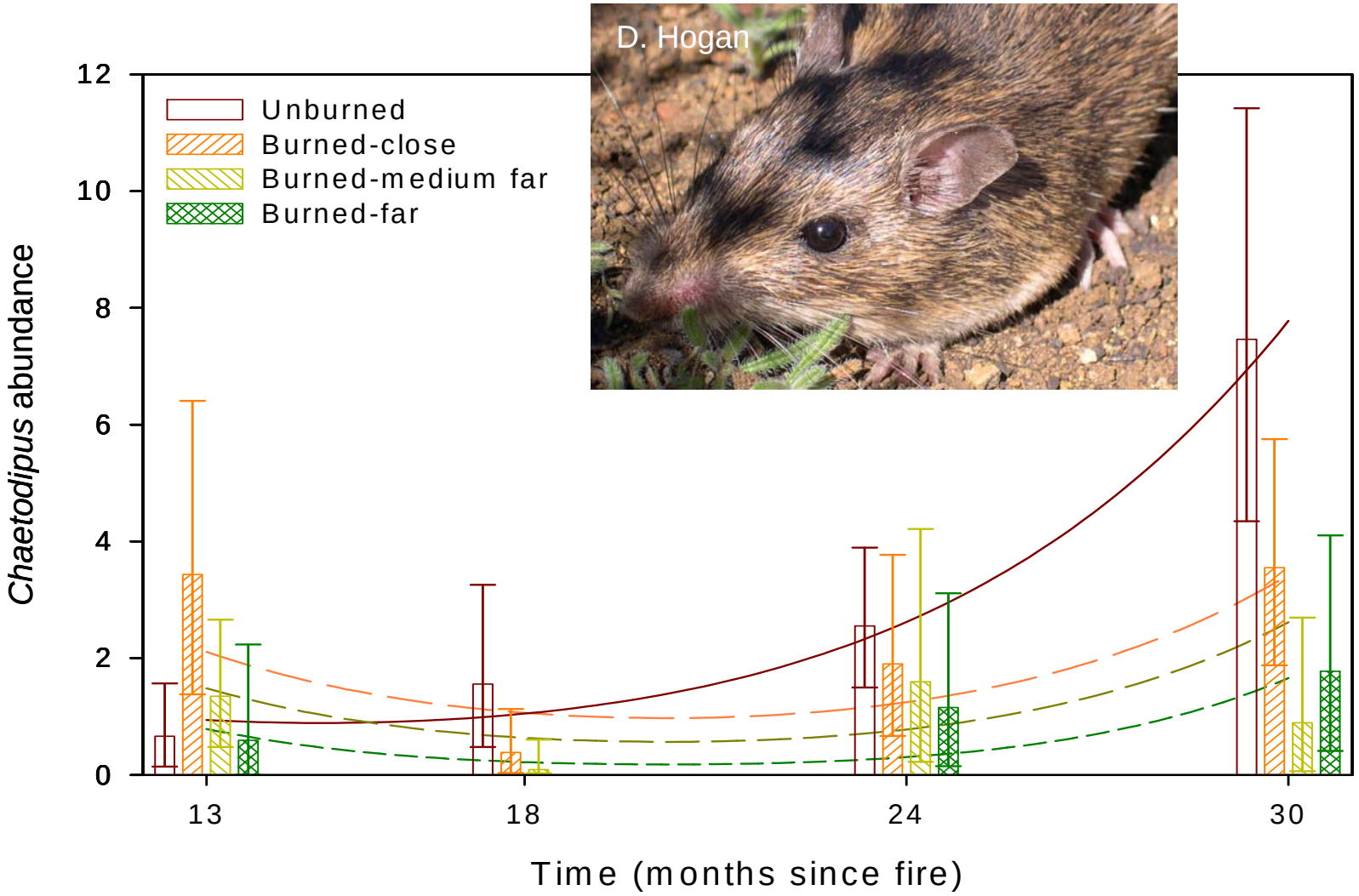
Dulzura Kangaroo Rat

Abundance trends differ with burn severity.

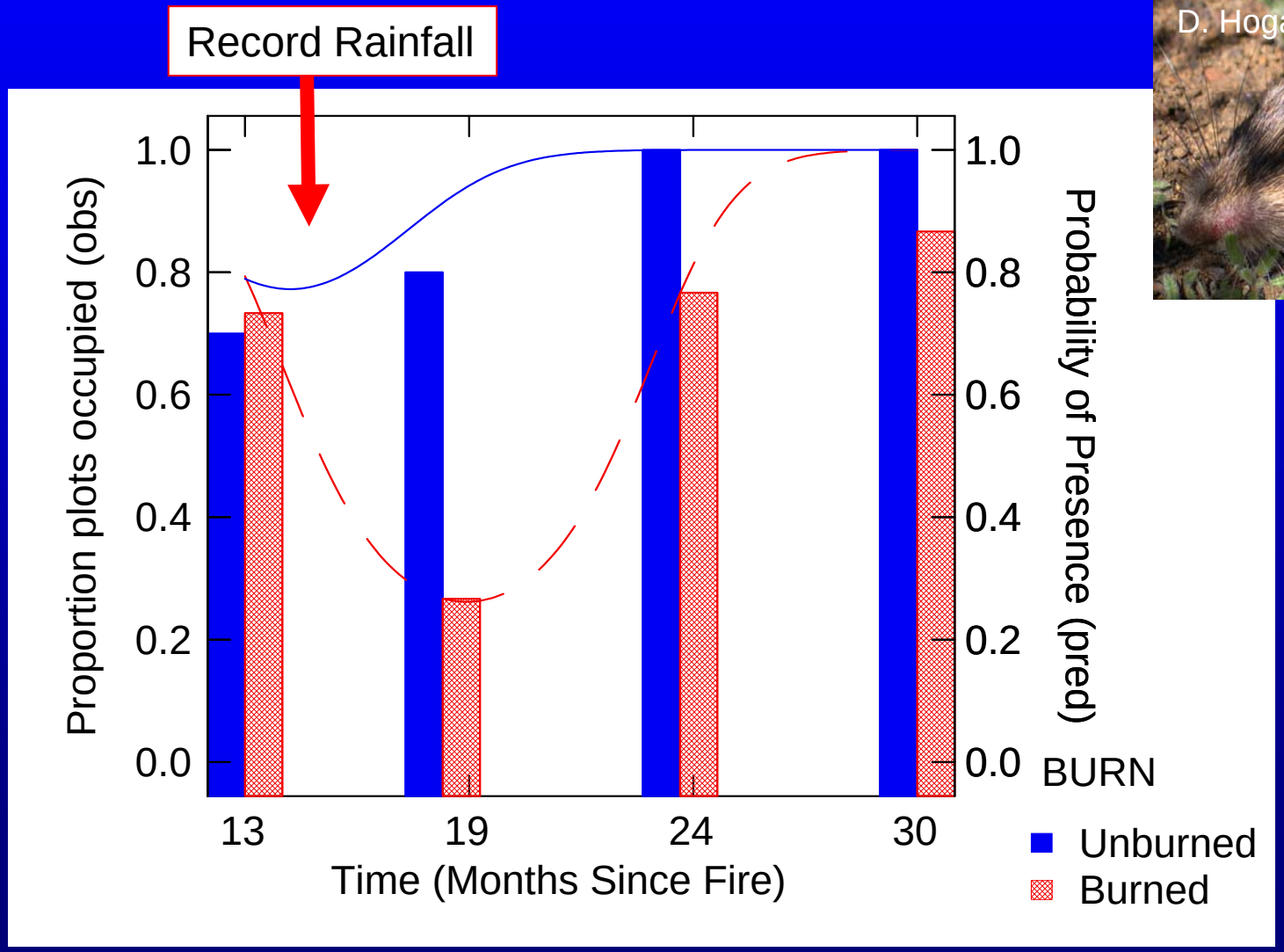


Pocket Mice (*Chaetodipus fallax, C. californicus*)

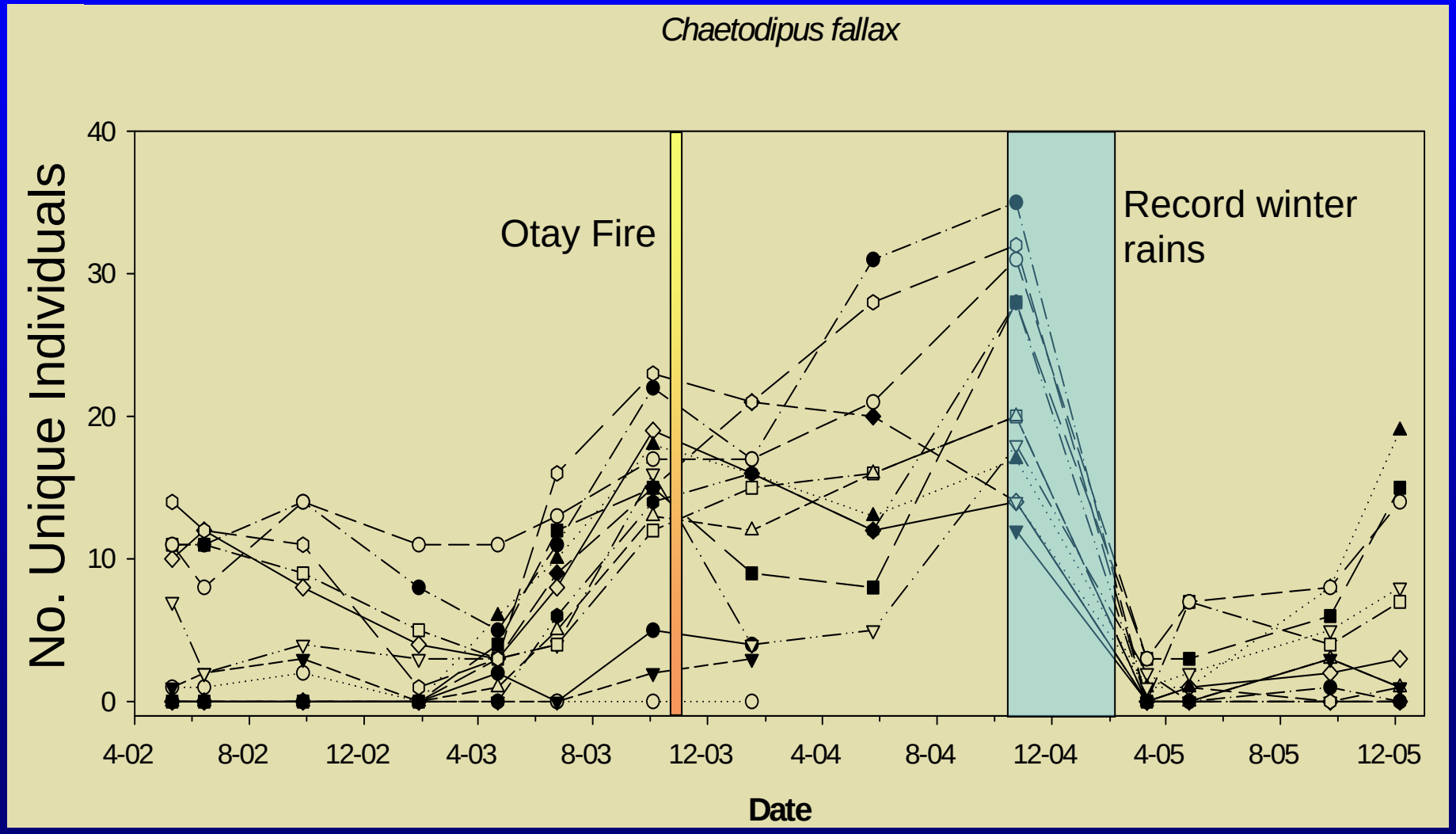
Abundance trends vary with distance from unburned edge.



Pocket Mice (*Chaetodipus fallax, C. californicus*) Occupancy declined following heavy rains on burned sites.

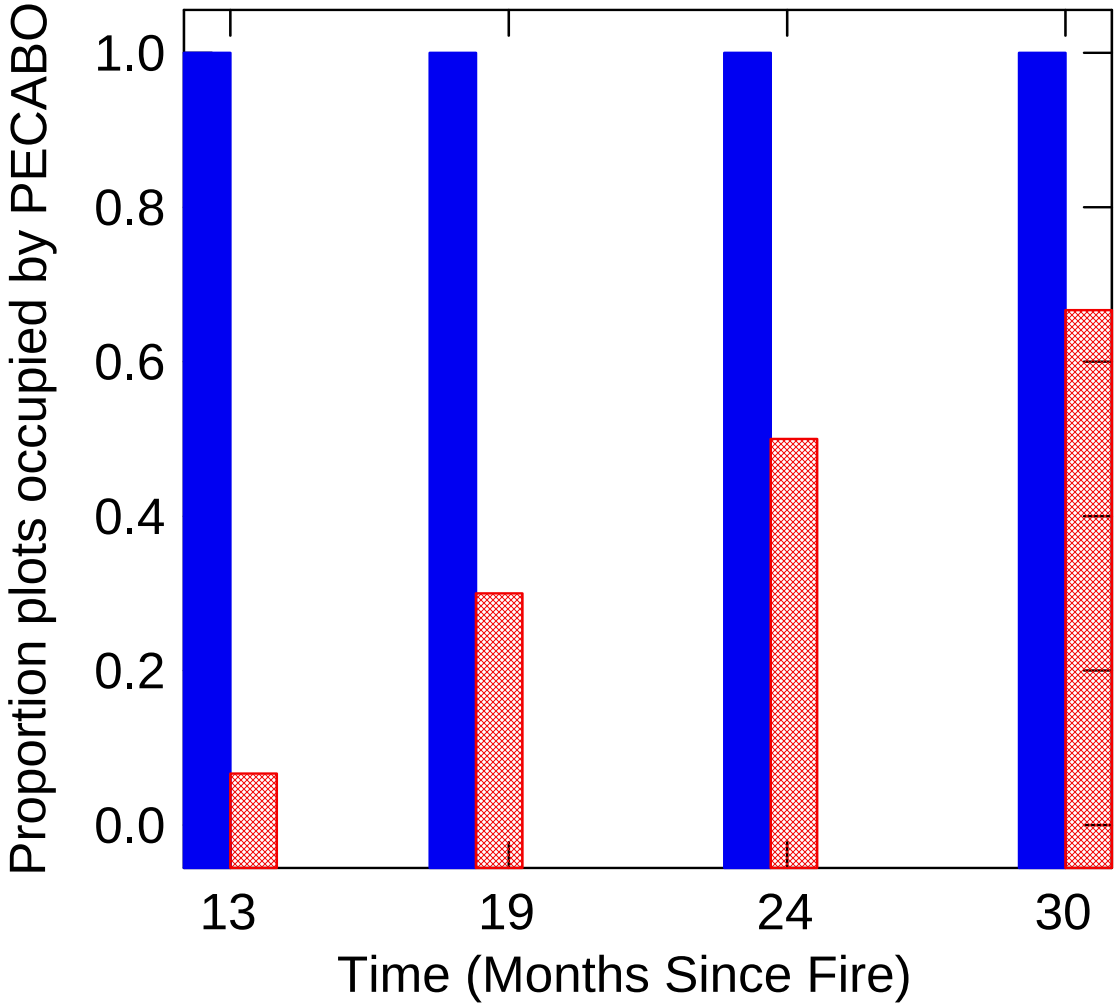


Effects of Fire and Rain on San Diego Pocket Mouse, Rancho Jamul Ecological Reserve



Brush Mice and California Mice

Consistently more common on unburned sites, but evidence of recolonization on burned sites.

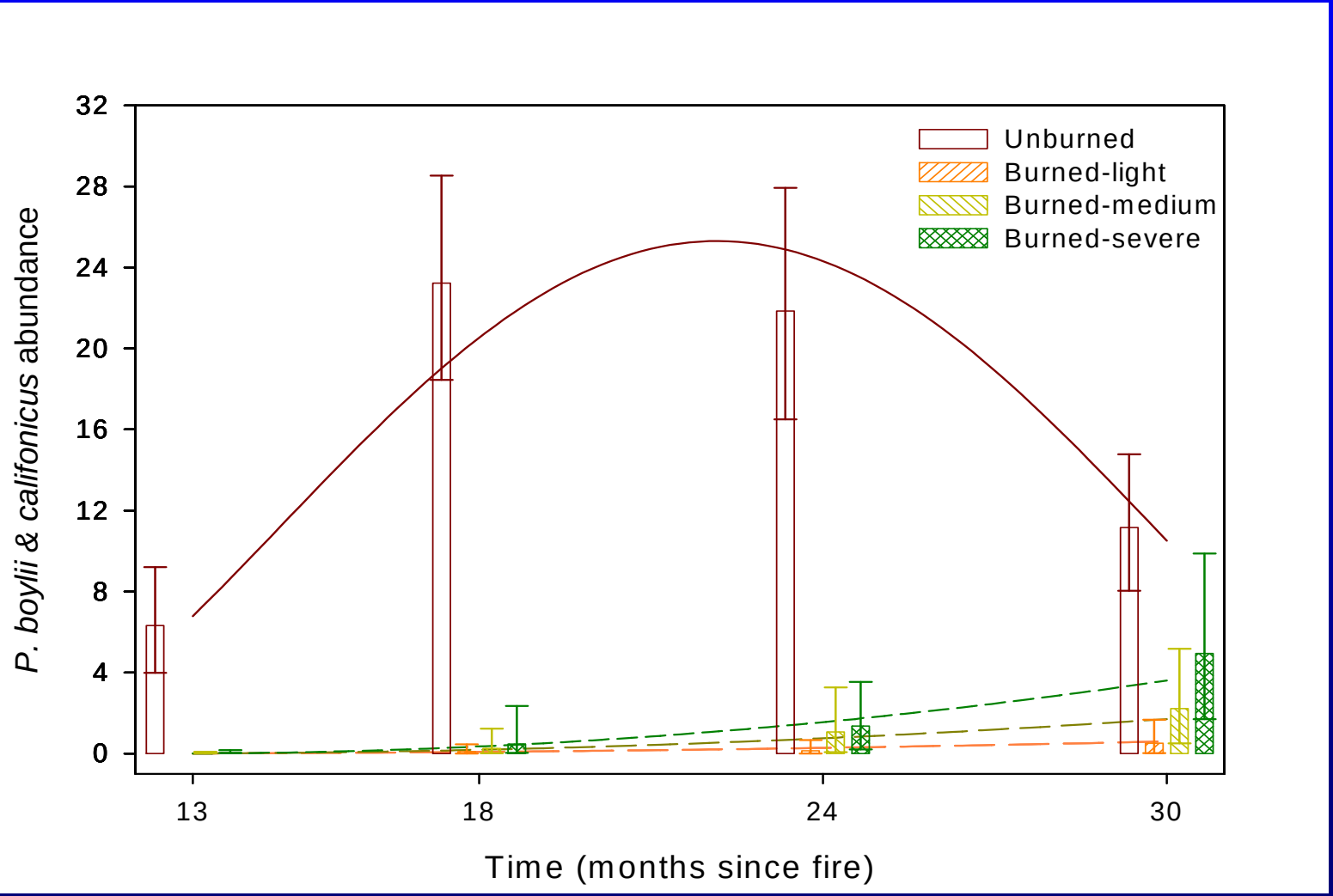


Burn Status

- Unburned
- Burned

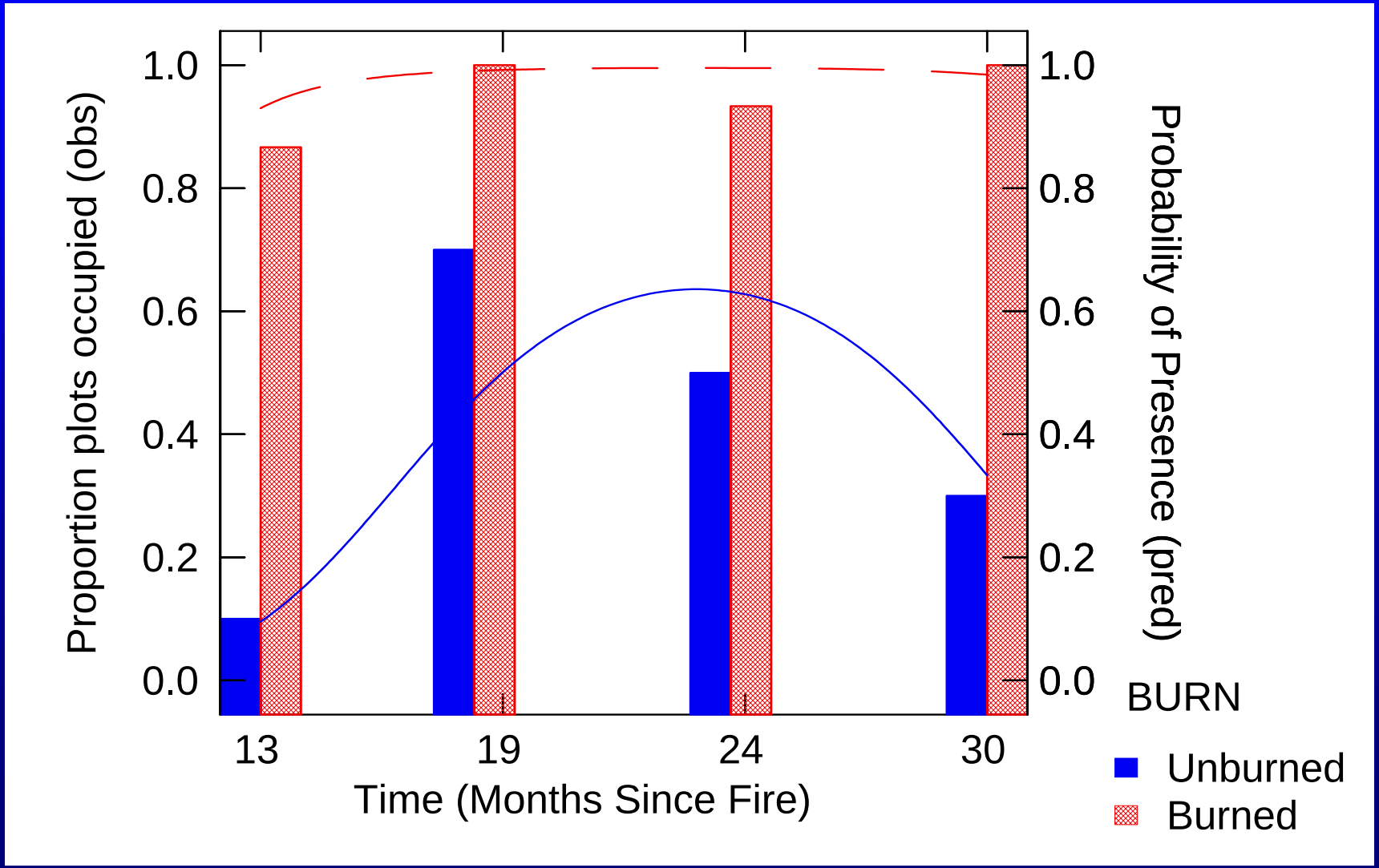
Brush Mice and California Mice

Weak evidence that fire severity effects abundance trends.



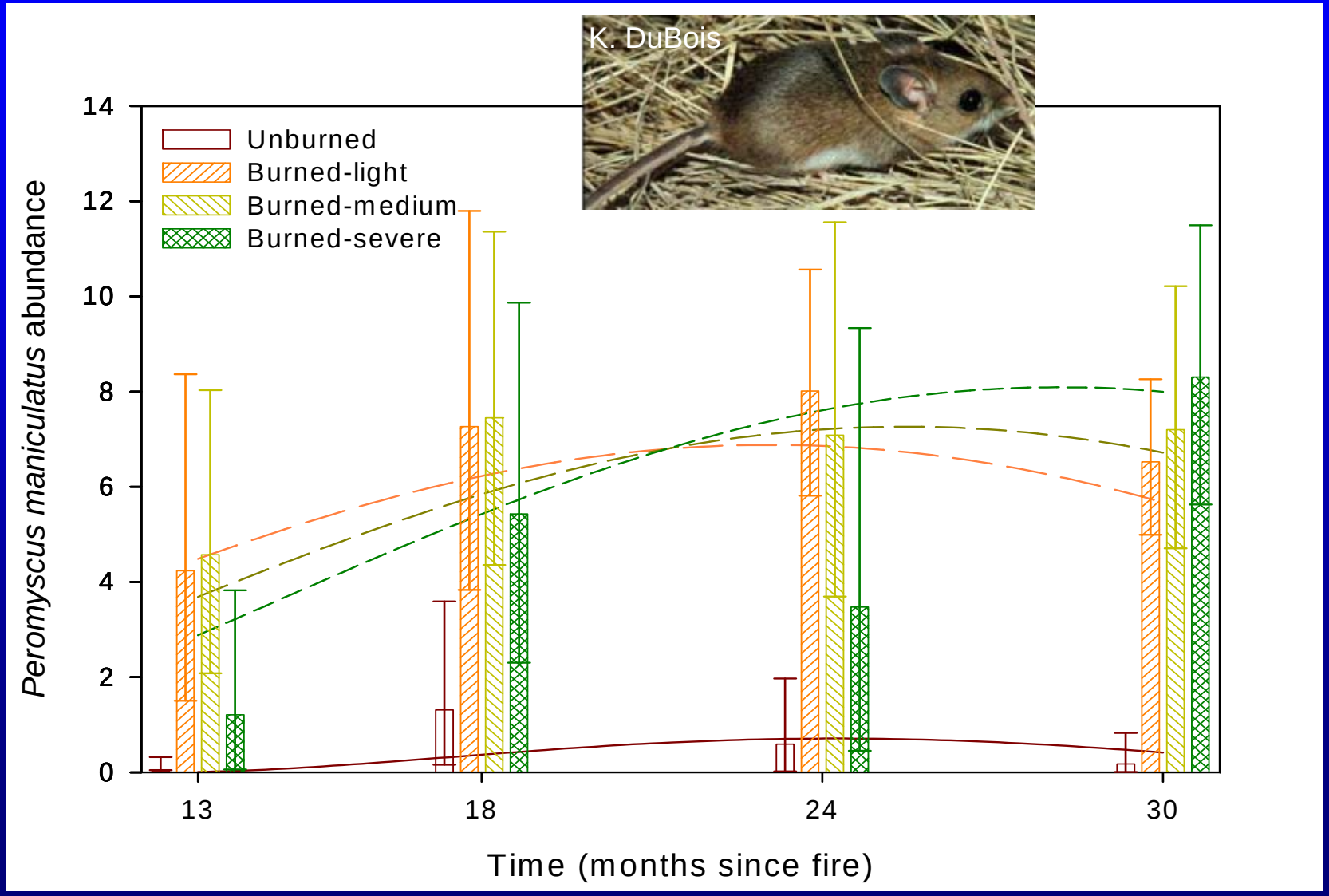
Deer Mice

Somewhat more widespread on burned sites.



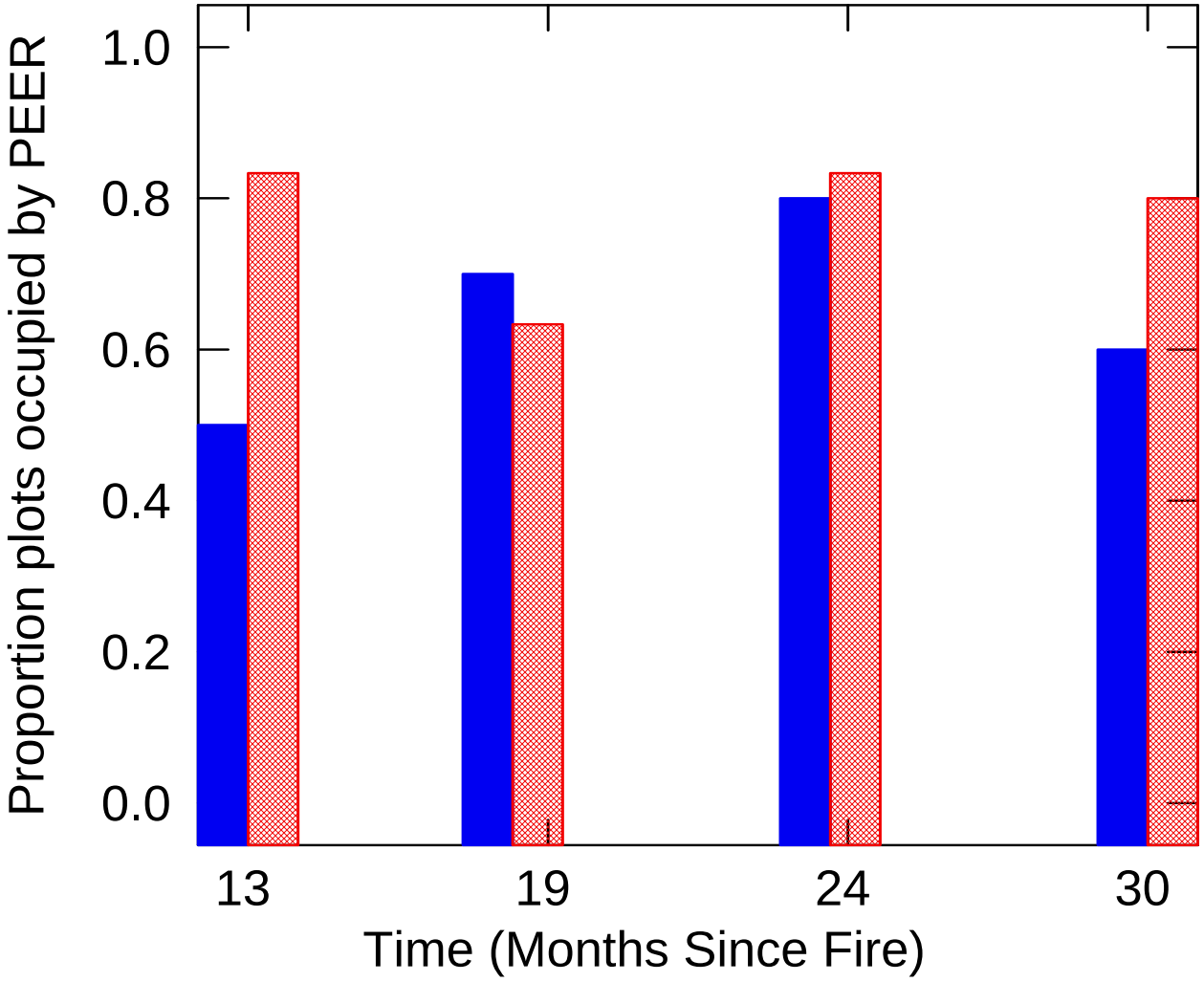
Deer Mice

Weak evidence of abundance trends varying with fire severity.



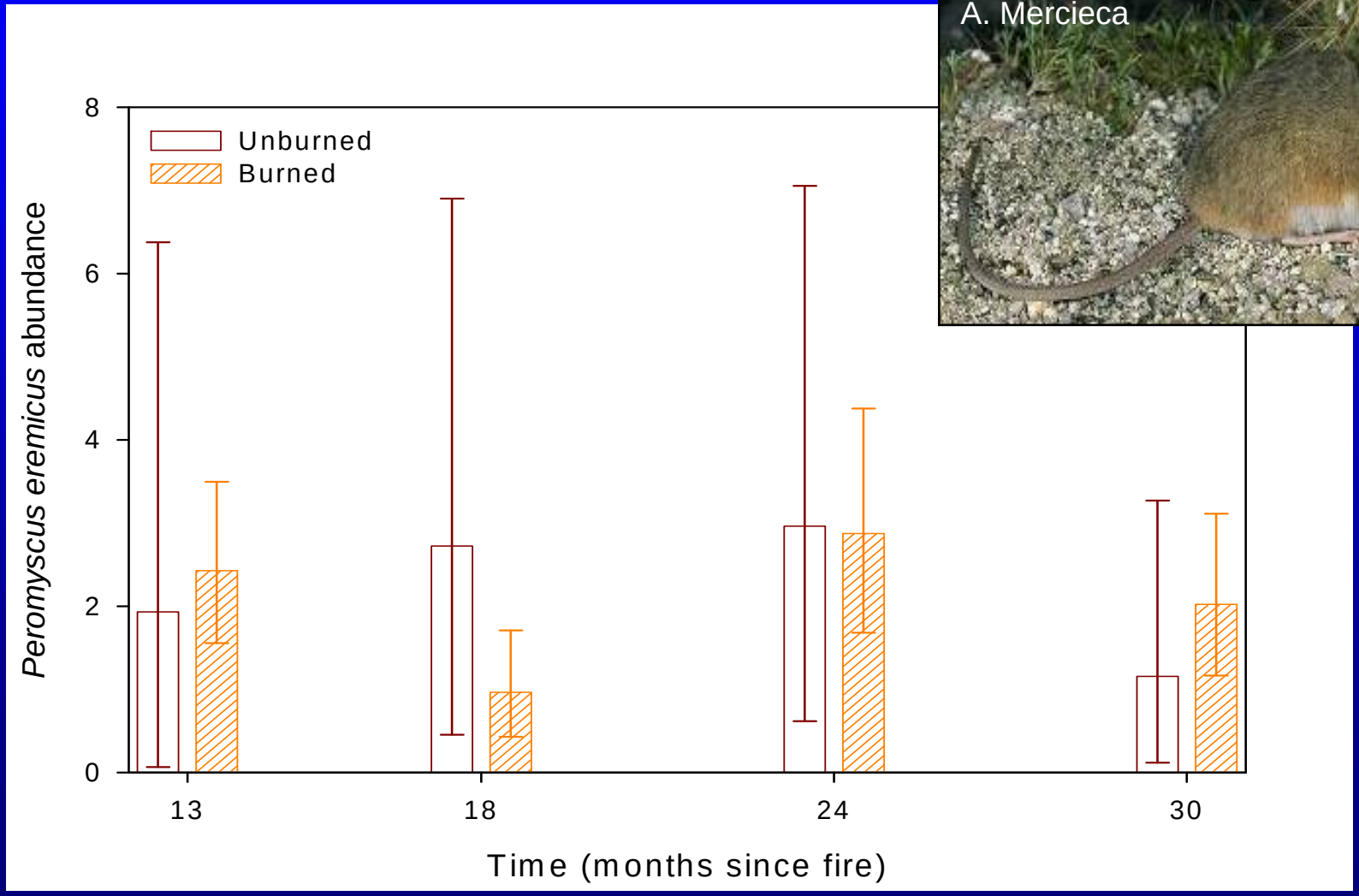
Cactus Mice

No difference in occupancy between burned and unburned sites.



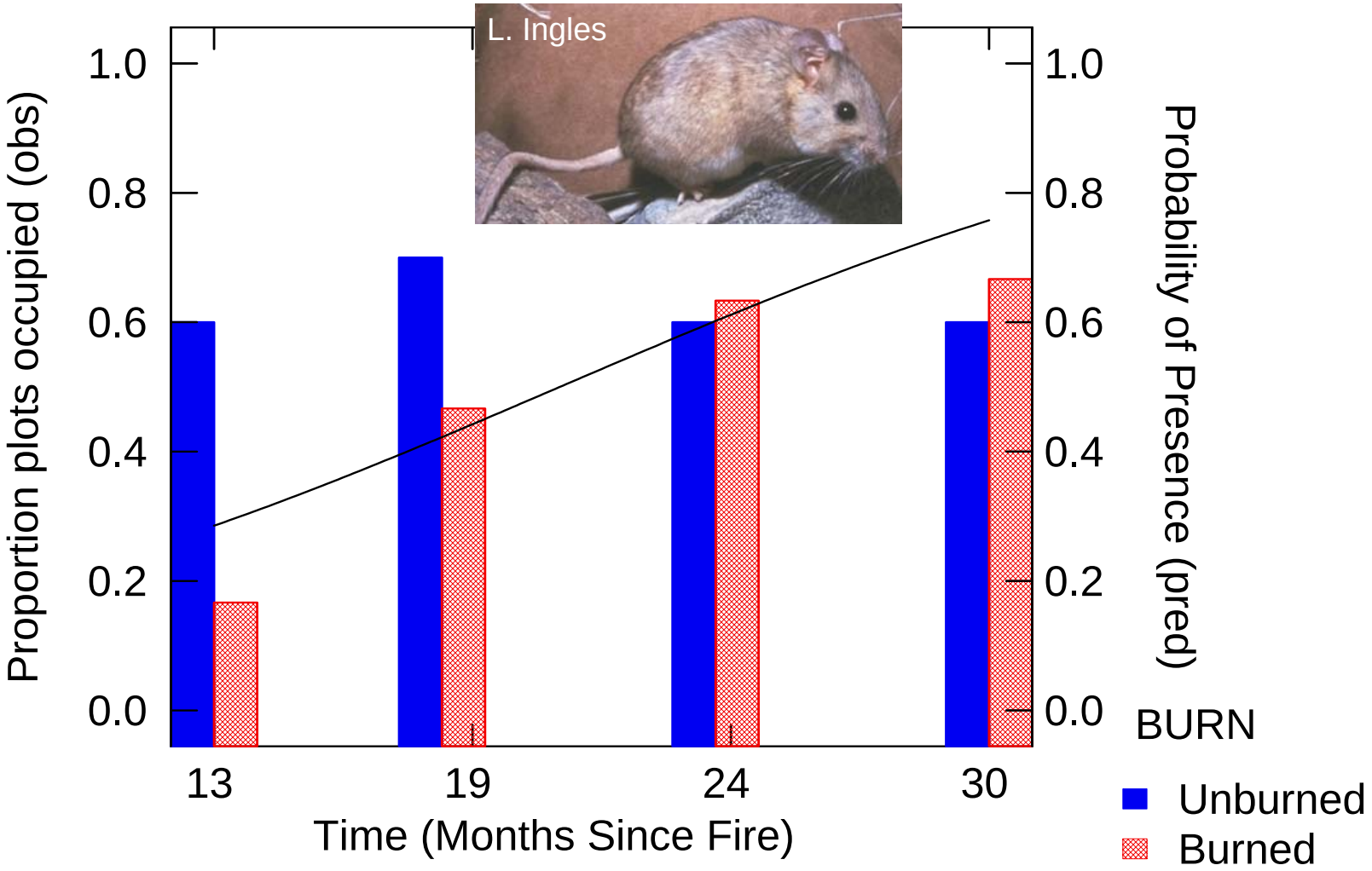
Cactus Mice

No difference in abundance or trends between burned and unburned sites.

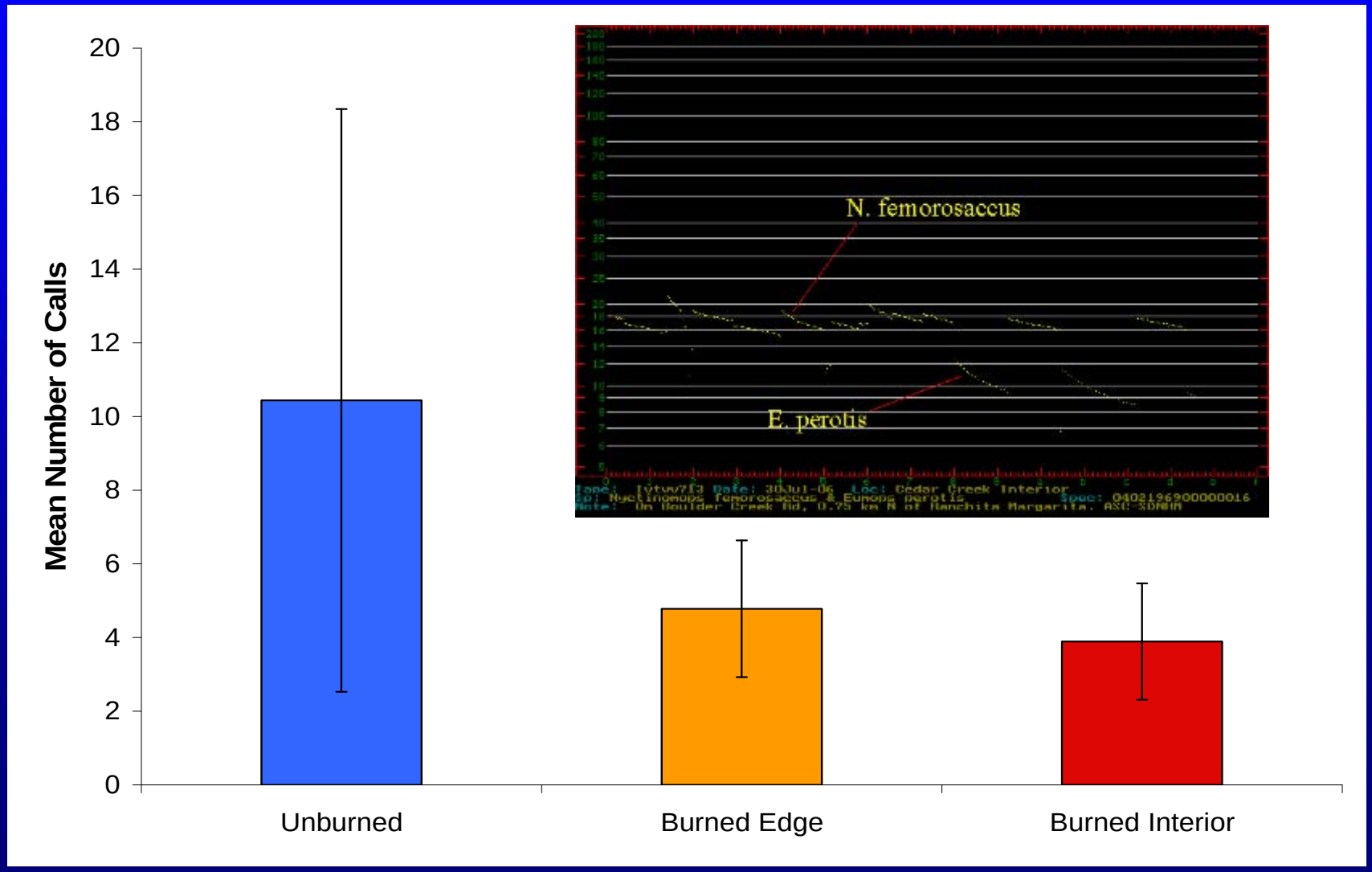


Desert Woodrats

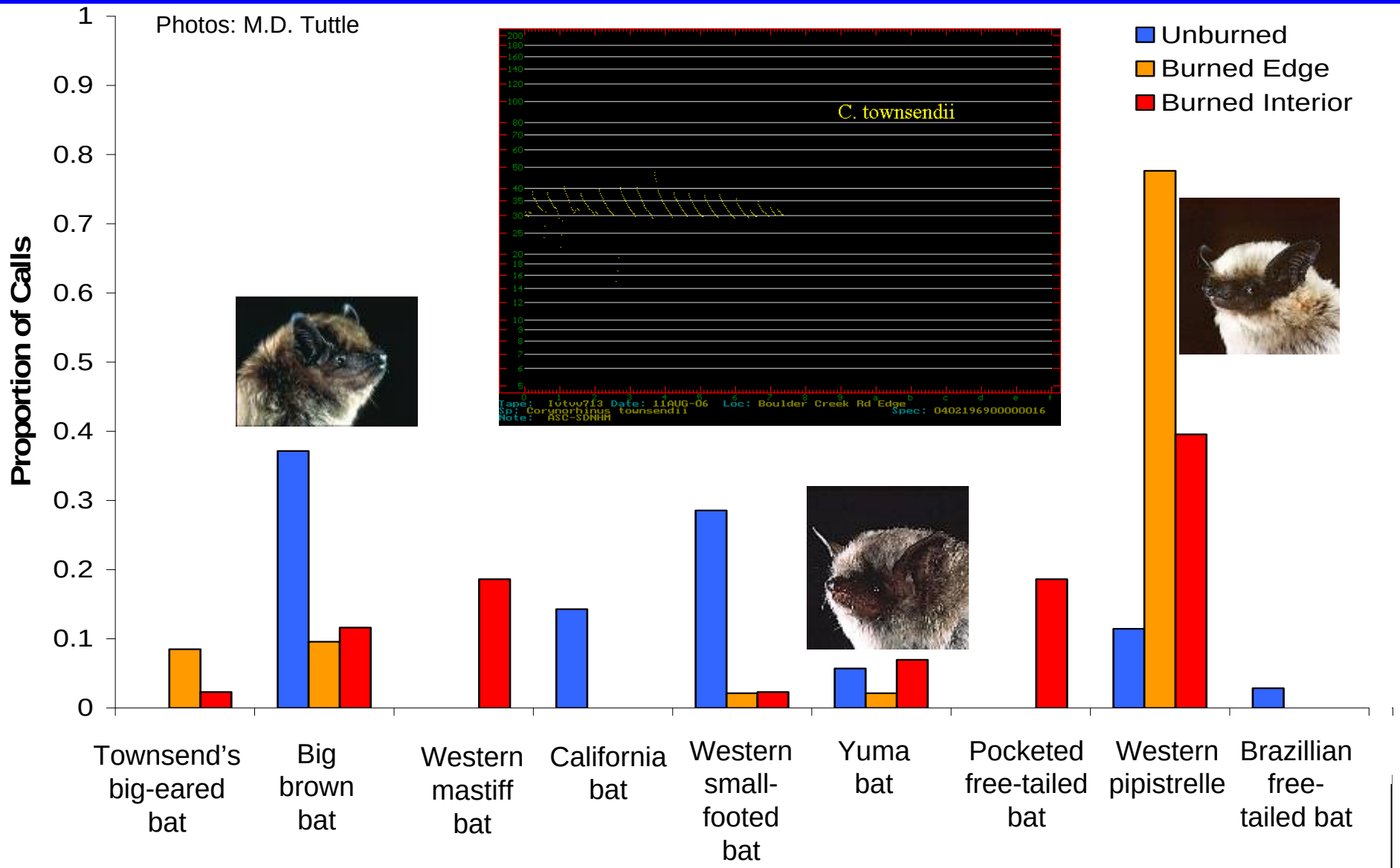
Low occupancy everywhere; but evidence of recolonization following fire.



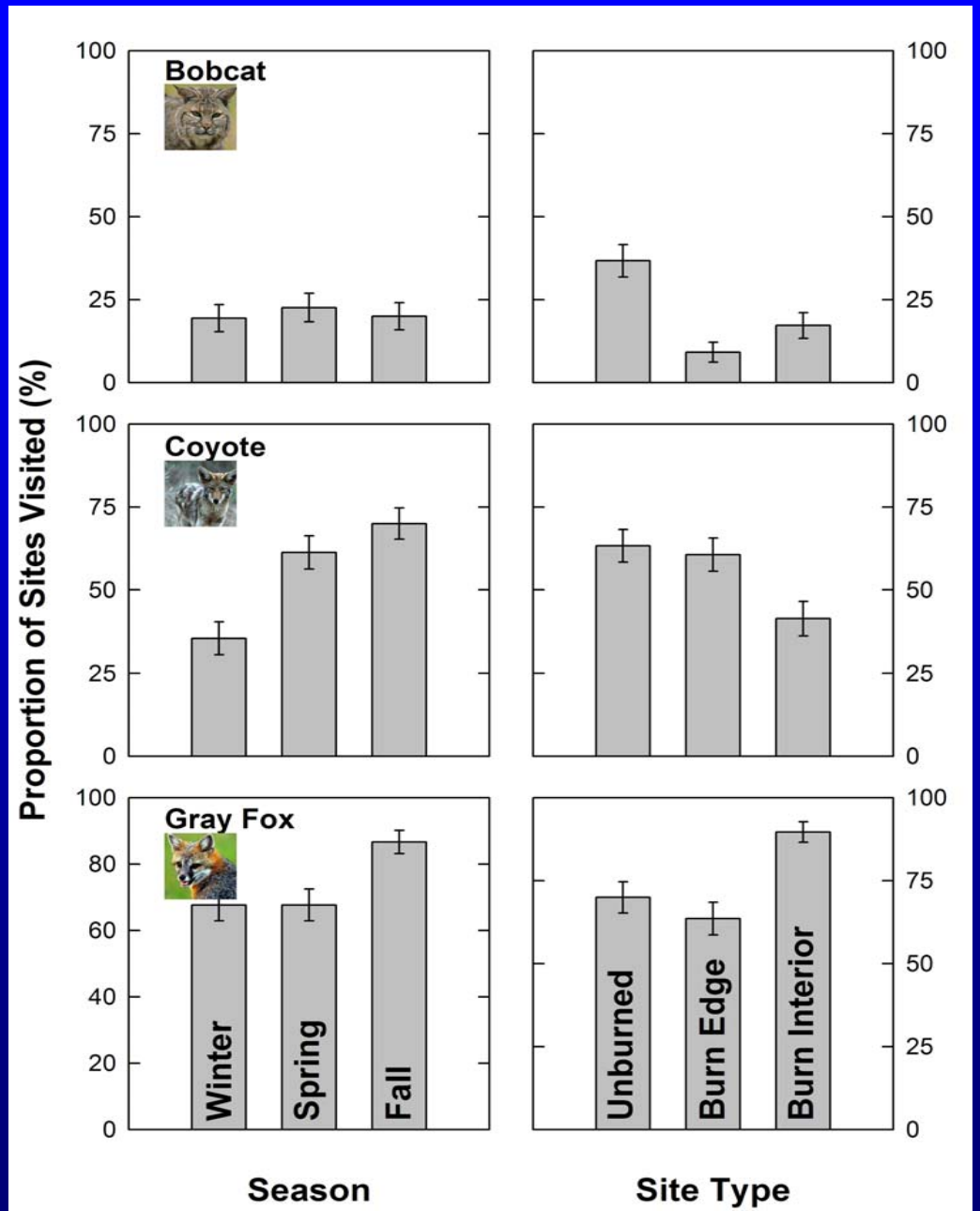
Bats – Calls Recorded by Burn Status



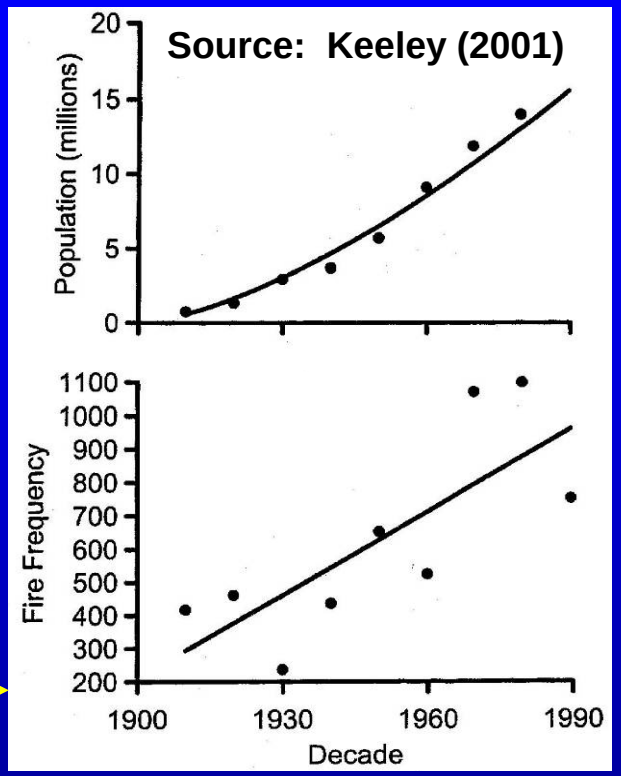
Bat Distribution
Relations to burn, unburn, and edge



Carnivore Detection Patterns



- Bobcats detected most often in unburned
- Coyotes detected least often in burn interior
- Gray fox detected most often in burn interior

Tentative Conclusions

- More time (and multivariate analyses) may reveal additional patterns
- Influences on post-fire recovery of chaparral mammal fauna:
  - Not so important?
    - Fire size
    - Fire severity
  - Perhaps more important?
    - Fire-return intervals (burn frequency) and type conversion
    - Fire patchiness
- Avoid extrapolating chaparral results to other communities:
  - E.g., montane forests