The “Rapture Hypothesis” Scenario
(...with apologies to REM)

- The planet heats up...
- Snowline rises...
- Alpine mammals are trapped...
- Unable to adapt physiologically....
- Habitat changes...
- Many populations appear doomed to disappear...
- But some may not ascend to the heavens from the mountains

It’s the end of the world as we know it...

And I feel fine!
Sierra Nevada/White Mountain Alpine Mammal Study

- 7-10 year study
- Multi-species study
  - Bighorn sheep
  - Yellow-bellied marmot
  - American pika
  - Belding’s ground squirrel
  - Golden-mantled ground squirrel
- Multi-scale
  - Rangewide
  - Regional
  - Local
- Estimate:
  - Occupancy
  - Habitat associations
  - Density
  - Demographic rates

- Model:
  - Resource selection
  - Species distributions
    - Climate
    - Topography
    - Vegetation
  - Population dynamics
    - Persistence

- Compare:
  - Among species
  - Among mountain ranges
  - Temperature gradient
What Are Implications Of Potential Range Changes Of Mammals On Vegetation States?

• Can mammals “manage their own habitat”
• Functional group changes
  – Changes in relative abundance
• Changes in distribution of interaction strengths
  – Herbivory → granivory dominated system
• Focus on interactions and feedbacks between climate and ecological/ecosystem processes
• Combination of observational, experimental, and modeling approaches
Project Linkages 2009 - 2012

Change In Land Cover Classes
(1972 - Present)

Mammal Density, Occupancy, Habitat Associations

Mammal Niche Models

Projected Meadow Conversion Models

Grazing-Herbivory Experiments
(Pinus contorta & P. albicaulis)

Remote Sensing Data
Climate Data

Transects
Point Counts
Habitat Sampling

Exclosures
Seeding

Evaluate interaction strength

Unadjusted
Adjusted for biotic interactions
Small Mammal Survey Methods

- Distribution and abundance data
  - **18 variable-distance line transects (616 km)**
    - Sierra Nevada
      - $N = 12$
      - 10 km
      - Sampled 4 times
      - 480 km
    - White Mountains
      - $N = 6$
      - 1.4 – 7.8 km
      - Sampled 5 times
      - 136 km
  - **June-September**
    - **5 point count stations per transect ($N = 90$)**
      - Sampled 3 times per season
A Few (very) Preliminary Results & Next Steps

• Density
  – No geographic pattern across Sierra Nevada
  – Density in White Mountains ≈3x greater than Sierra Nevada
    • 3.8 ± 0.4 km² vs. 13.6 ± 1.9 km²
  – Complex patterns of variation

• Occupancy
  – (43.3 %) 45.9 ± 5.2 %
  – Two-strata model

• Habitat associations
  – > 91% of observations in talus/meadow ecotones

• Next steps
  – Demographic studies
  – Integral projection models