

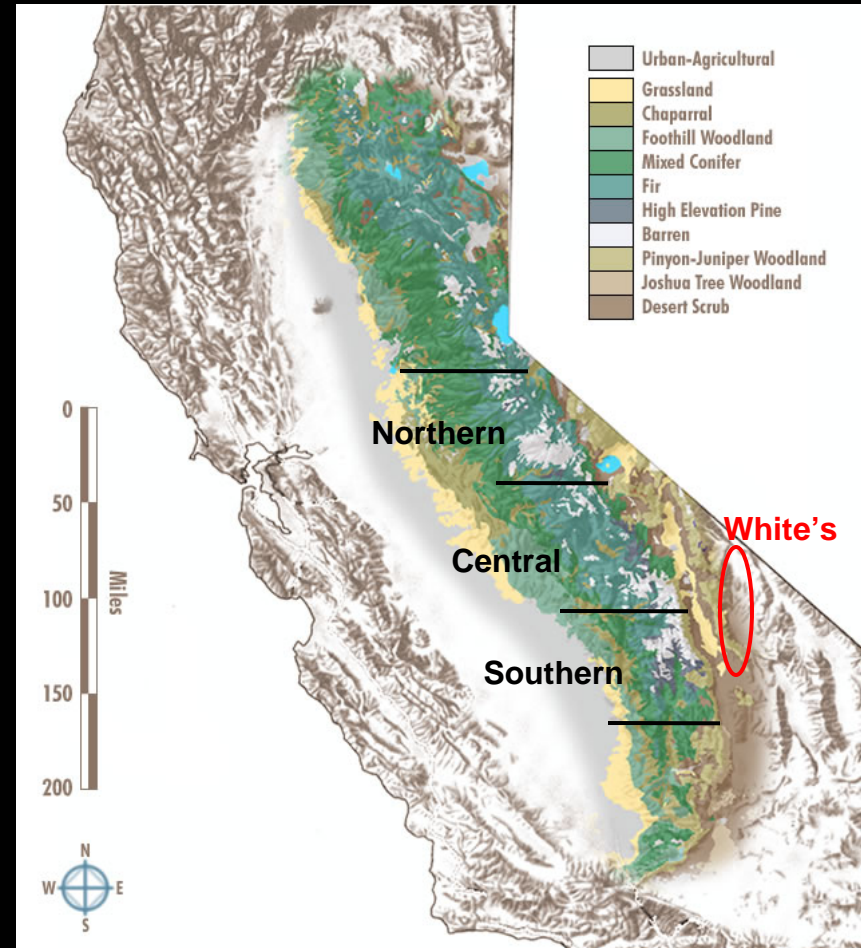


**USGS Pika Research Update
Sierra Nevada & White Mountains**

2008-2010

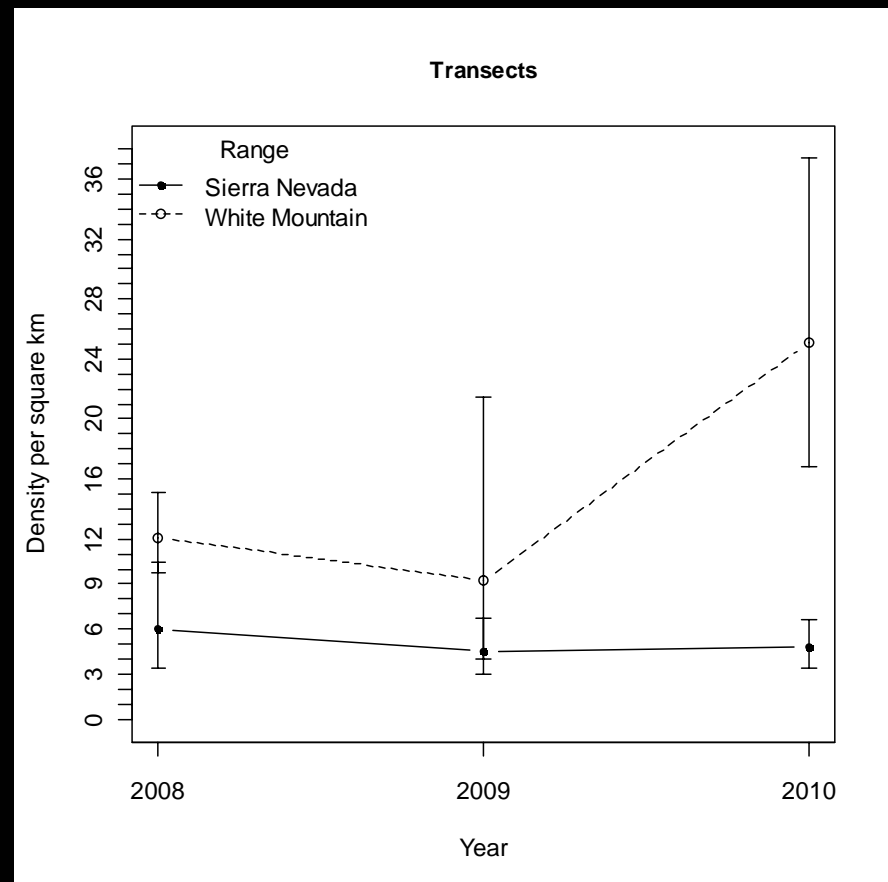
Sampling Summary

- **Regional density estimates**
 - Variable-distance line transect counts
 - Sierra Nevada (10 km length)
 - White Mountains (1.4 – 7.8 km)
- **Local & patch-scale abundance estimates and occupancy**
 - Variable-distance point counts
 - Sierra Nevada only



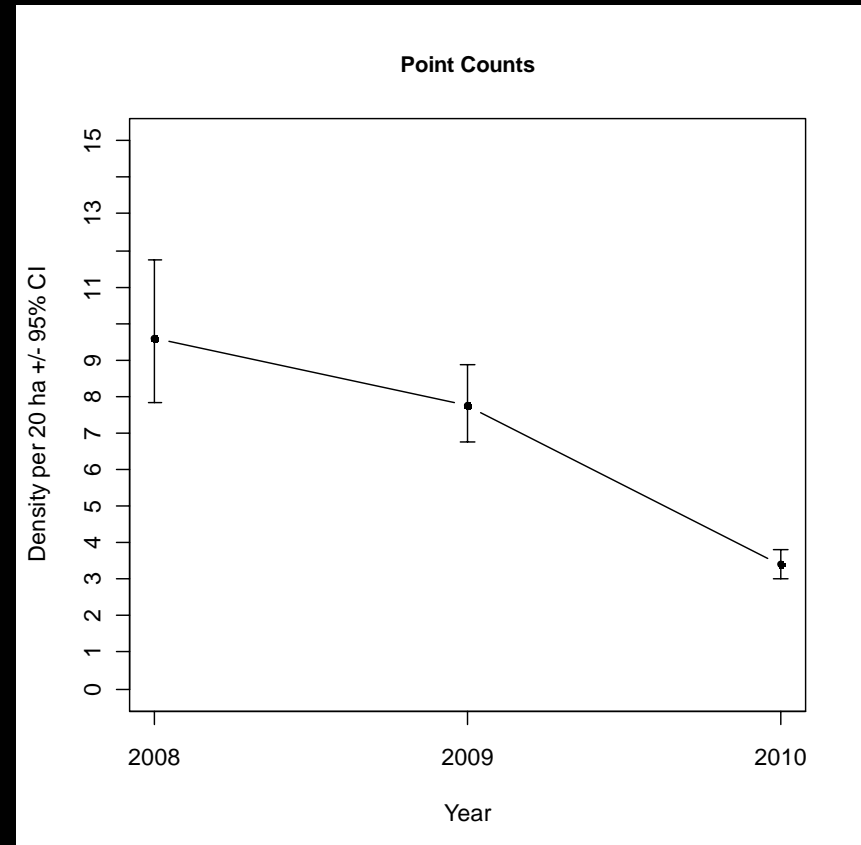
Some Results

- Regional density estimates
 - Estimates generally higher in White Mountain range than Sierra
 - More spatially variable in White's



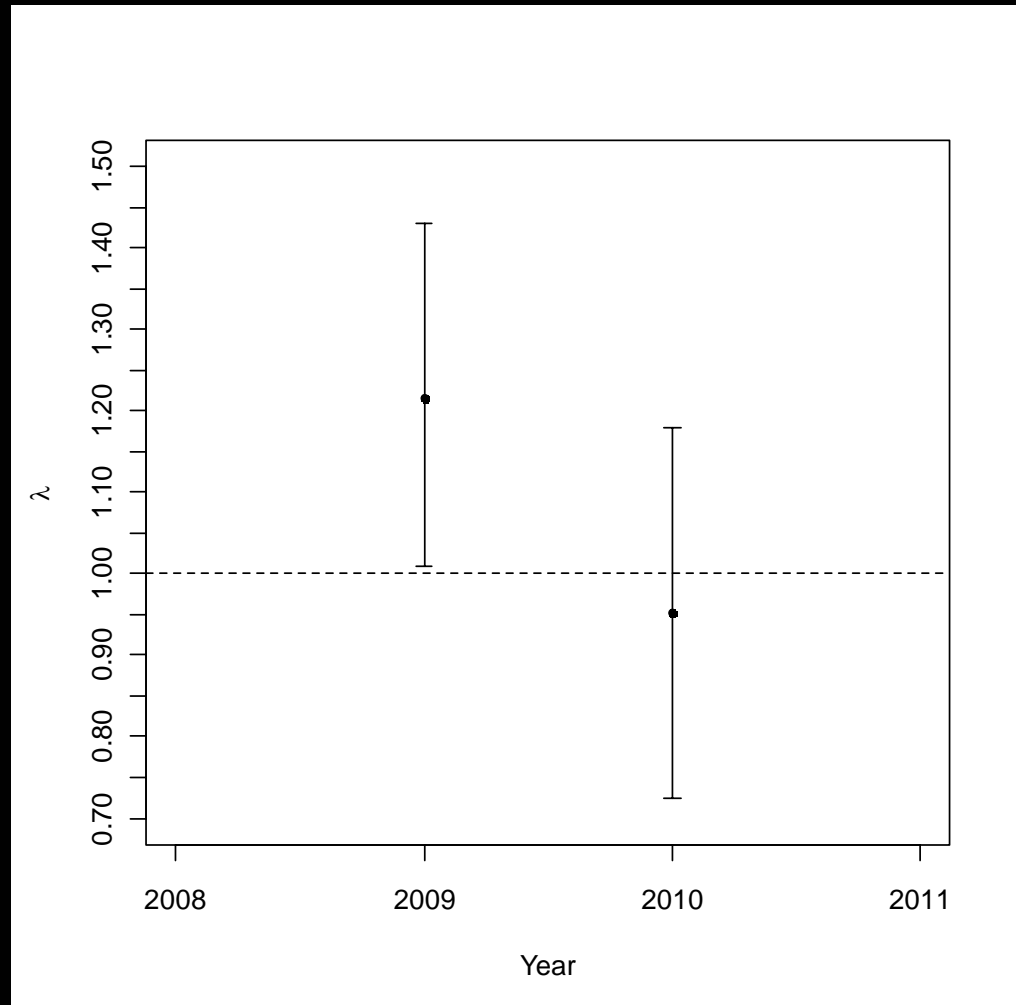
Some Results

- Local density estimates (Sierra Nevada only)
 - Estimate for 2010 approximately half that in 2008 and 2009



Some Results

- Occupancy patterns for sites surveyed in all three years (N = 40)
 - Expansion of occupied sites between 2008 and 2009
 - Relative stability between 2009 and 2010



Macrohabitat Variables That Influenced Occupancy And Abundance

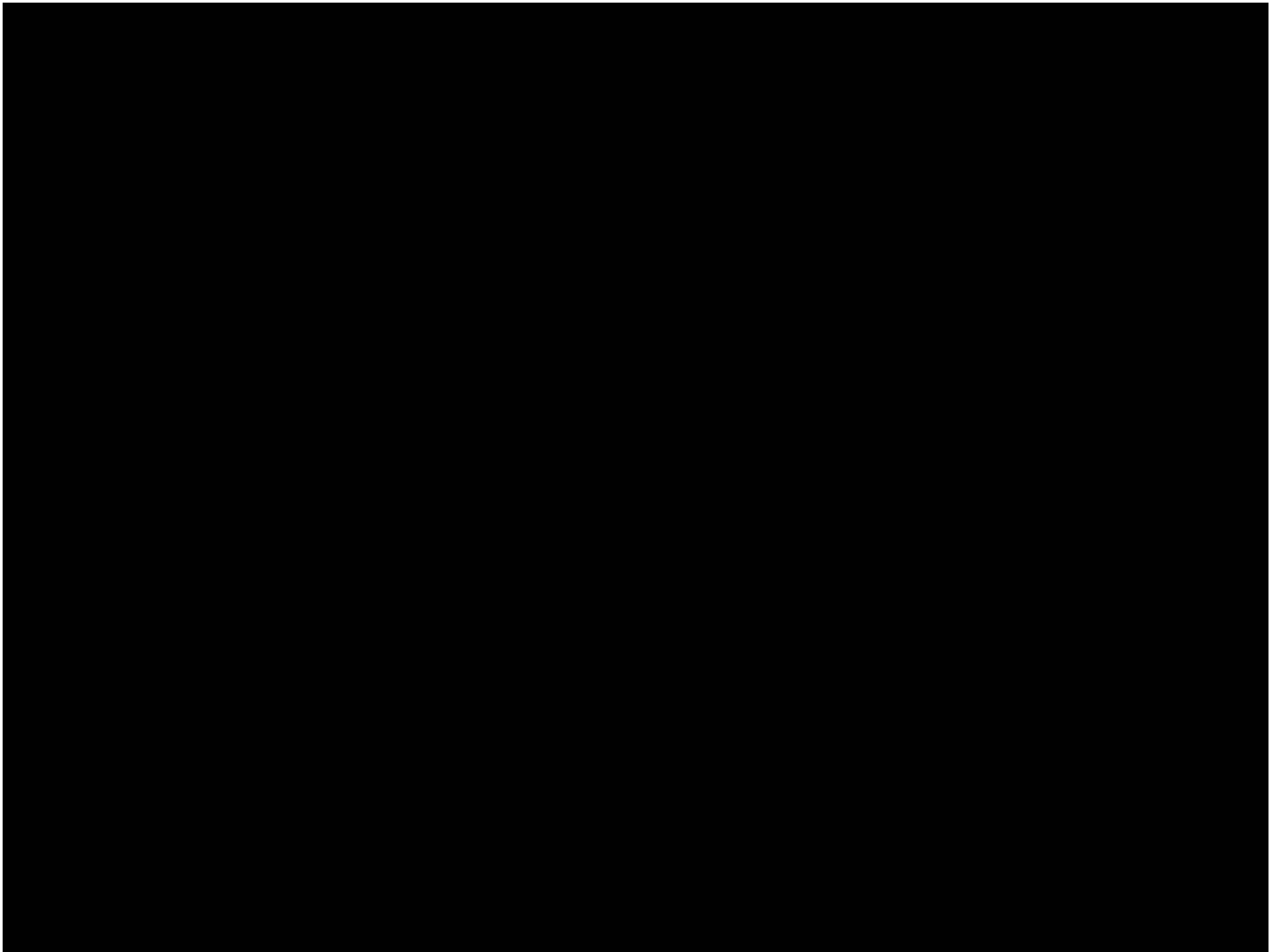
- Six models comprised 70% of relative support and consisted of additive effects of:
 - Elevation (positive relationship)
 - Rock (positive relationship)
 - Simpson's index (measure of habitat heterogeneity; positive relationship)
 - Meadow (negative relationship)
 - Conifer (negative relationship)



Plans For 2011

- **Surveys**
 - One additional transect (and 10 point count stations) to be added in Sequoia
 - N = 20 transects and 200 point count stations
 - Each will be sampled four times
- **Microhabitat sampling**
 - 123 plots to be sampled
- **Focused activity and behavioral work**



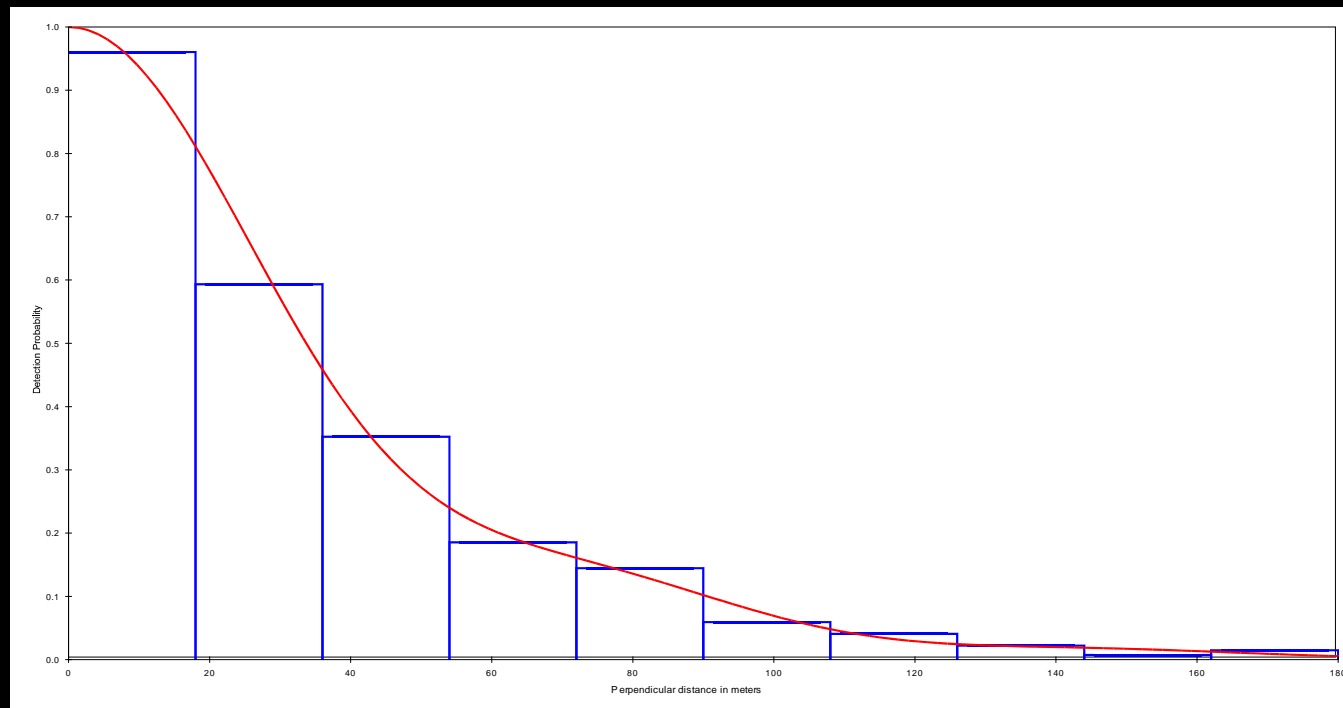


Plans For 2011

- **Analyses**
 - Inclusion of downscaled climate data, snow layer data, and microhabitat data into habitat and occupancy models
 - Test multiplicative models along with additive models
- **Develop proposals for continuation and expansion of project (funding for current project ends in September)**
 - One proposal currently under review by NPS climate change program
 - Use current study as foundation to address more mechanistic questions



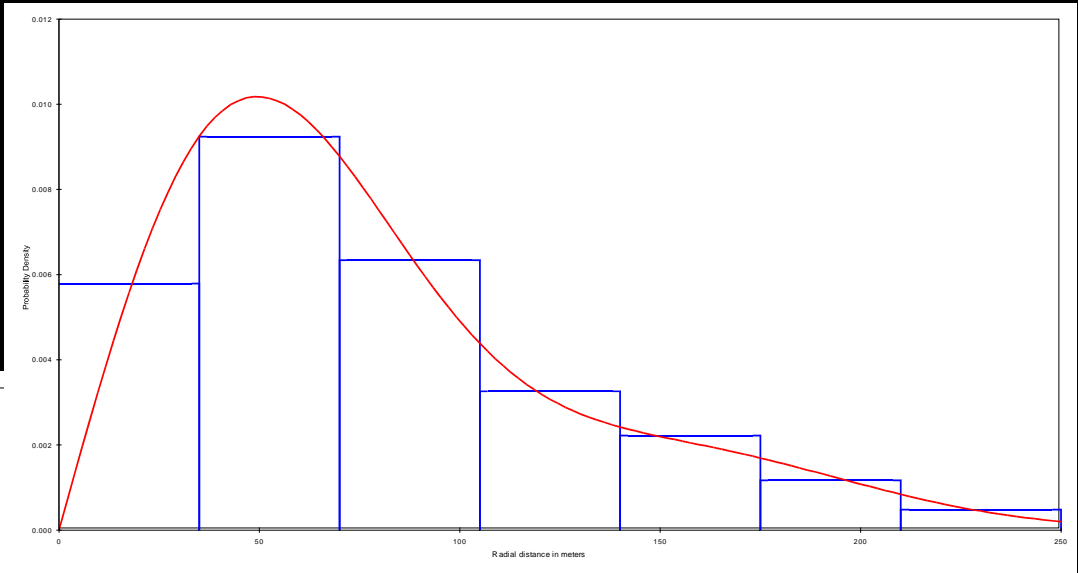
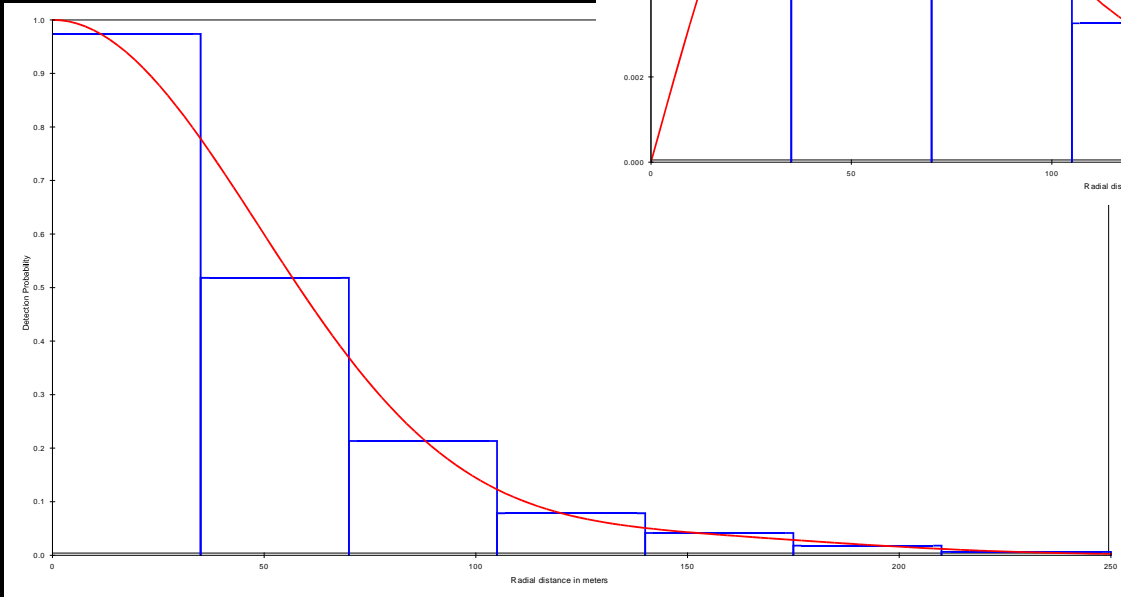
Some Results



Extremely good fit of detection function to data for transects...

Some Results

...and point counts



Probability density function

Detection function

Sampling Summary

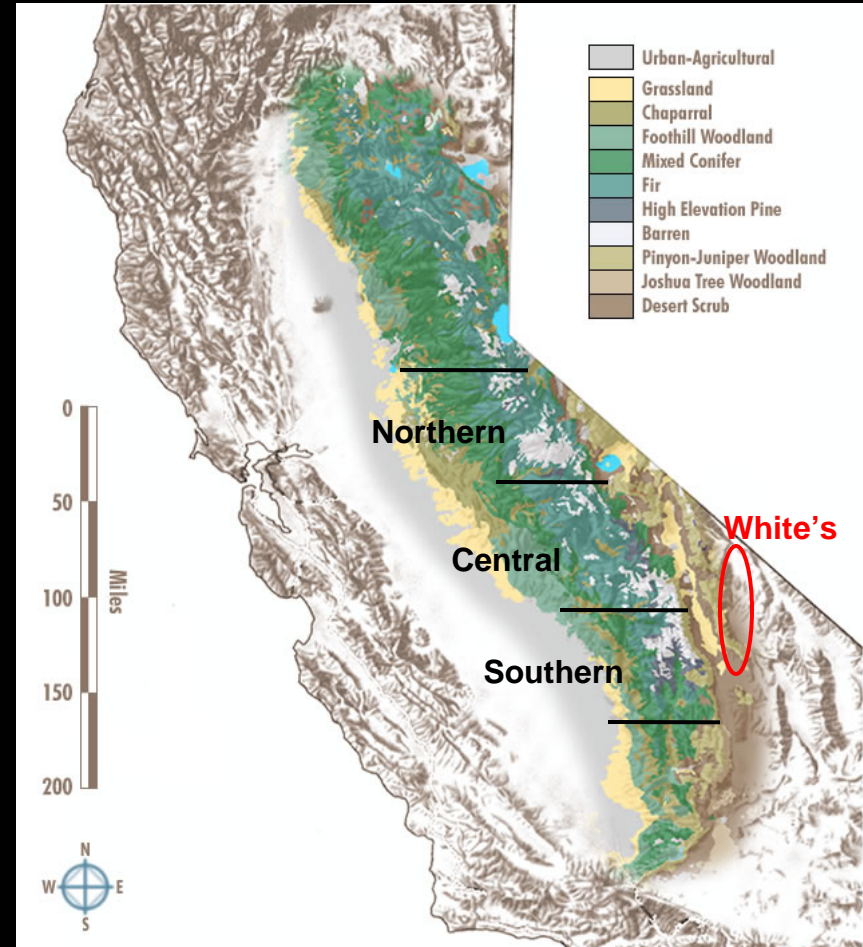
- **Habitat structure**

- Microhabitat variables

- **180 vegetation sampling plots**

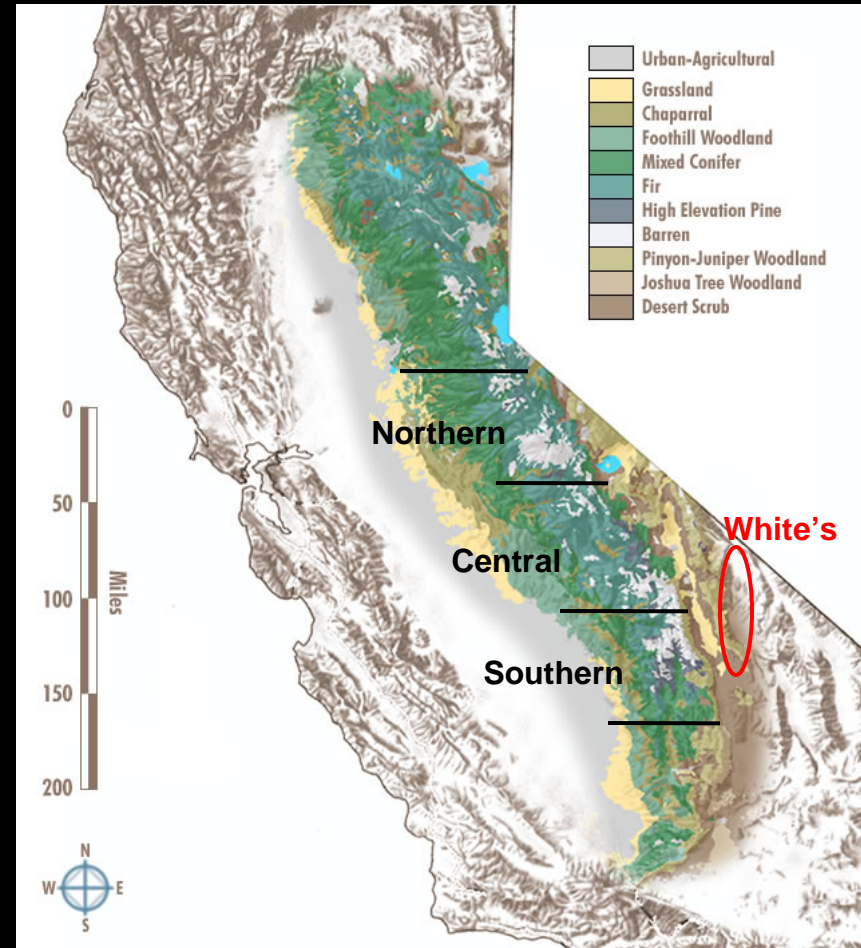
- 30 each for pika, bighorn sheep, marmot and 2 ground squirrel species, plus 30 random plots

- » Woody and herbaceous cover
- » Woody density
- » Herbaceous biomass
- » Rock & bare ground
- » Soil moisture



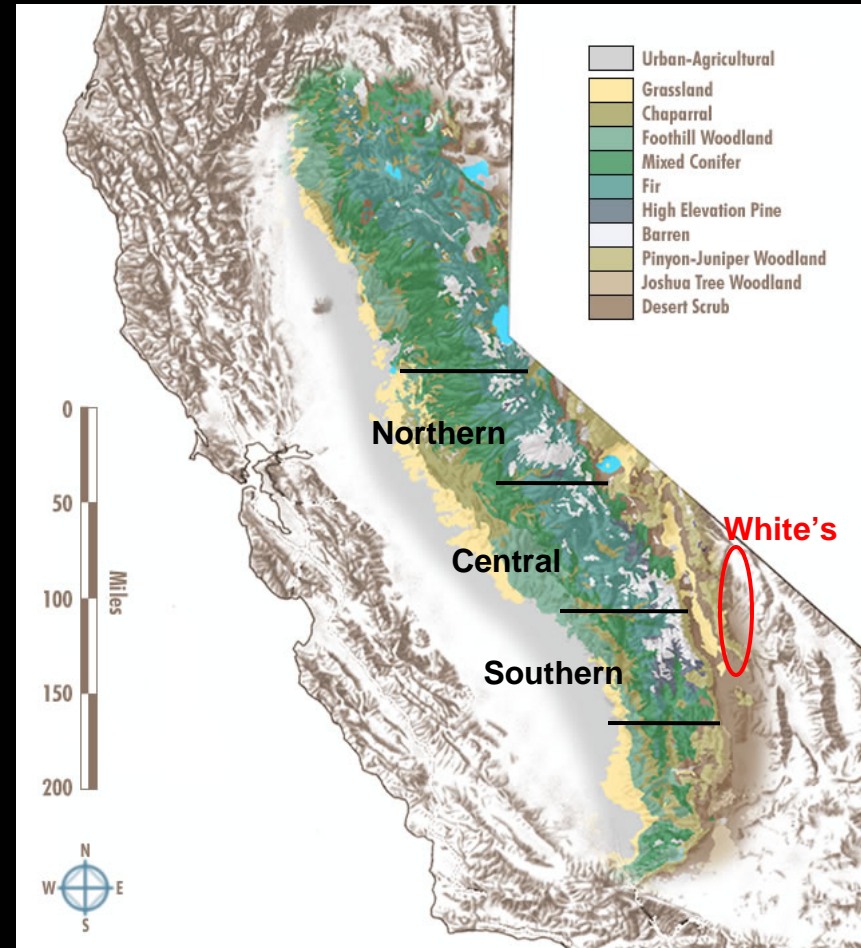
Sampling Summary

- **Regional density estimates**
 - **Variable-distance line transect counts**
 - **Sierra Nevada (10 km length)**
 - 2008
 - » N = 9
 - » Sampled 3 times June-August
 - 2009
 - » N = 12
 - » Sampled 3 times July-August
 - 2010
 - » N = 19
 - » Sampled 4 times July-August
 - **White Mountains (1.4 – 7.8 km)**
 - 2008 - 2009
 - » N = 6
 - » Sampled 3 times June-September
 - 2010
 - » N = 5
 - » Sampled 3-4 times June-July



Sampling Summary

- Local & patch-scale abundance estimates and occupancy
 - Variable-distance point counts
 - Sierra Nevada only
 - 2008
 - » N = 40
 - » 5 randomly located points per transect
 - » Sampled 3 times June-August
 - 2009
 - » N = 60
 - » 5 randomly located points per transect
 - » Sampled 3 times June-August
 - 2010
 - » N = 190
 - » 10 randomly located points per transect
 - » Sampled 4 times June-August



Macrohabitat Variables That Influenced Occupancy And Abundance

- Six models comprised 70% of relative support (N = 28 models total)
- The six models consisted of additive effects of:
 - Elevation (positive relationship)
 - Simpson's index (measure of habitat heterogeneity; positive relationship)
 - Rock (positive relationship)
 - Meadow (negative relationship)
 - Conifer (negative relationship)
- The six models consisted of combinations of 3-5 of the variables



Macrohabitat Variables Influencing Occupancy And Abundance

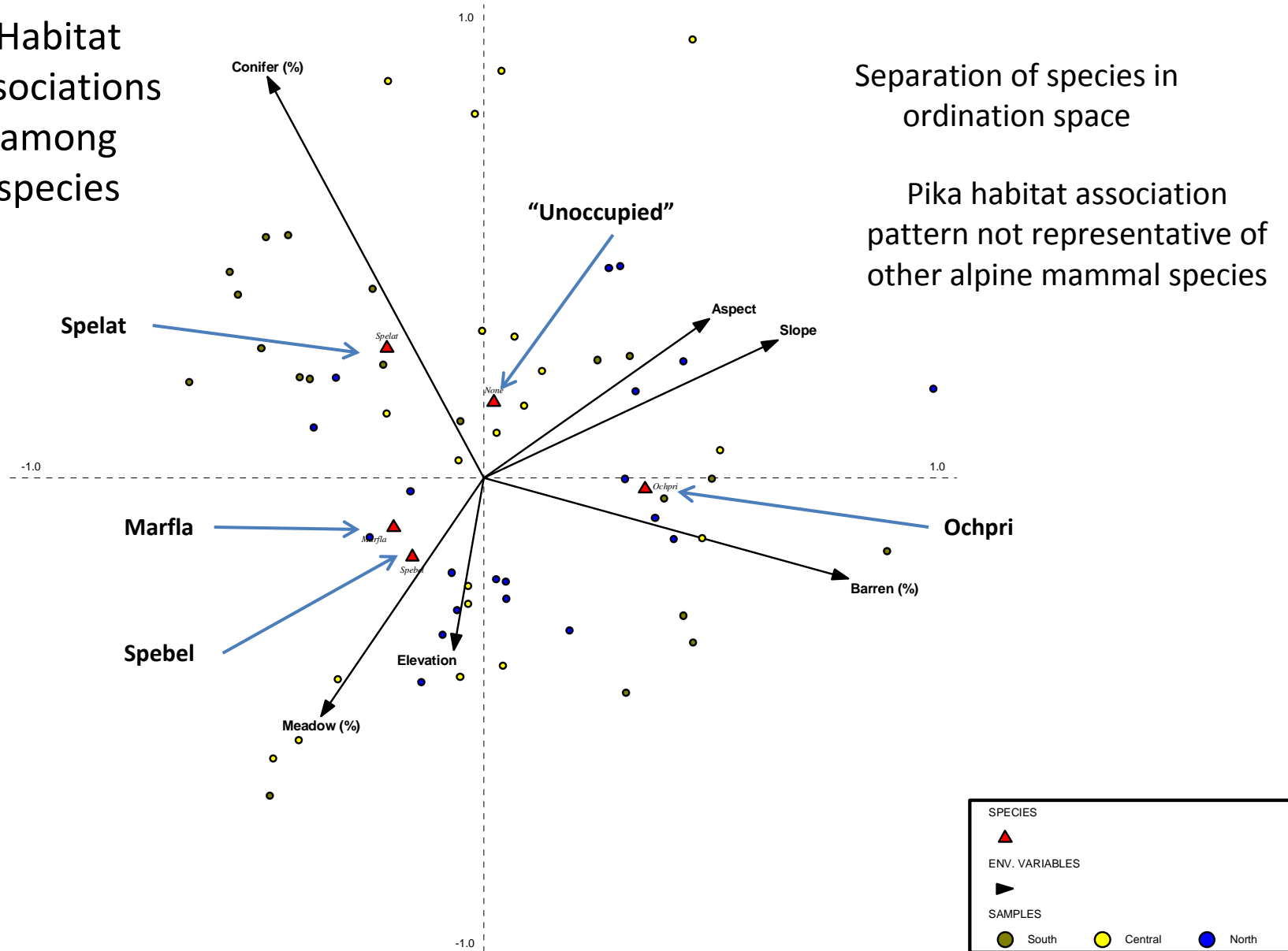
- **Interpretation**
 - Multiple variables strongly suggest pika habitat associations and occupancy are more than just climate
 - Positive relationship with elevation and rock expected
 - Positive relationship with Simpson's index suggests importance of habitat diversity
 - Negative meadow and conifer relationships also suggests importance of habitat diversity



Habitat associations among species

Separation of species in ordination space

Pika habitat association pattern not representative of other alpine mammal species



Canonical Correspondence Analysis