Establishing the baseline:

Historical biogeography of the American Pika

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Collaborators:

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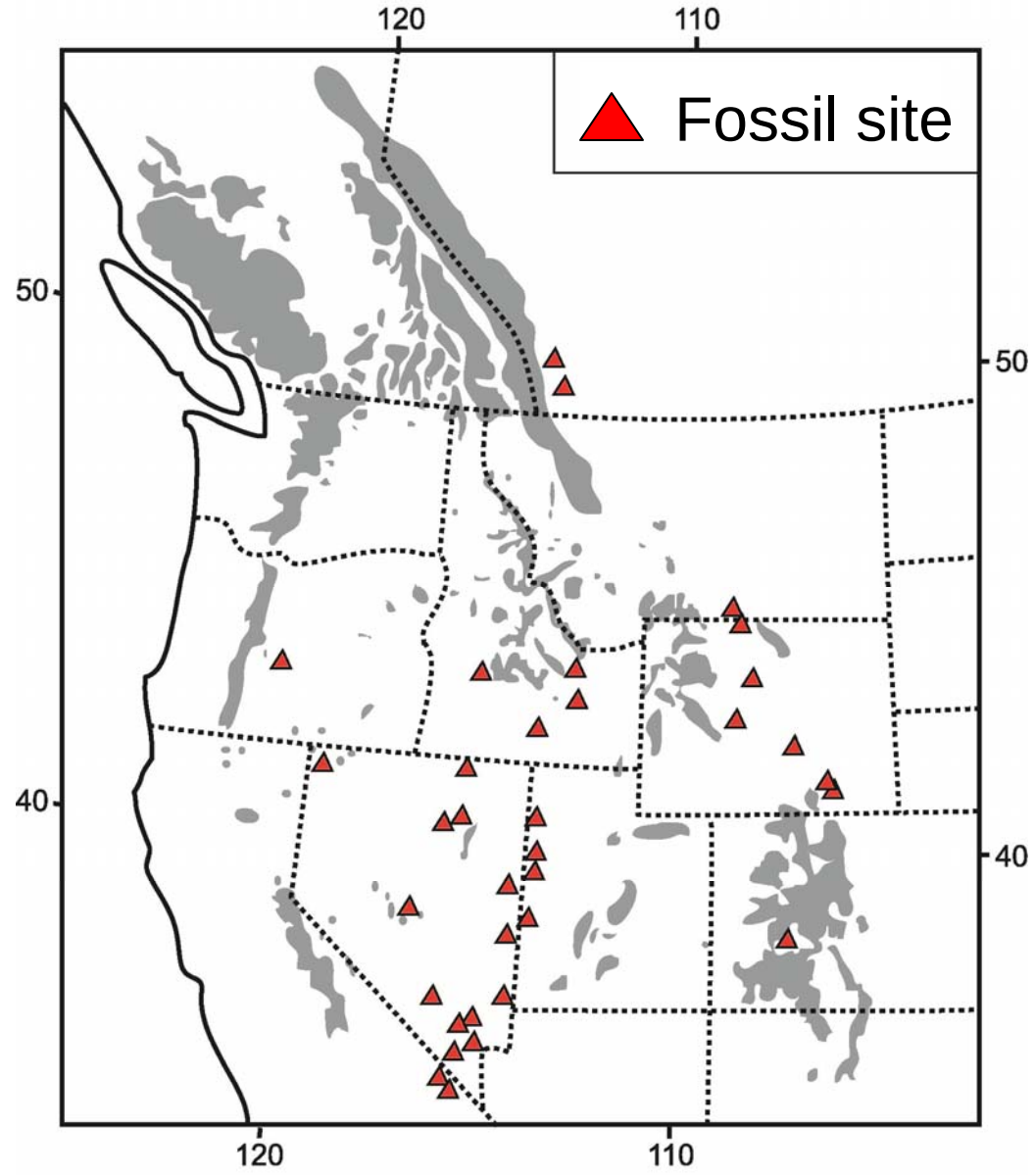
Historical perspective reveals:

Distribution and origins of major diversity

Consequences of historical climate fluctuations for populations

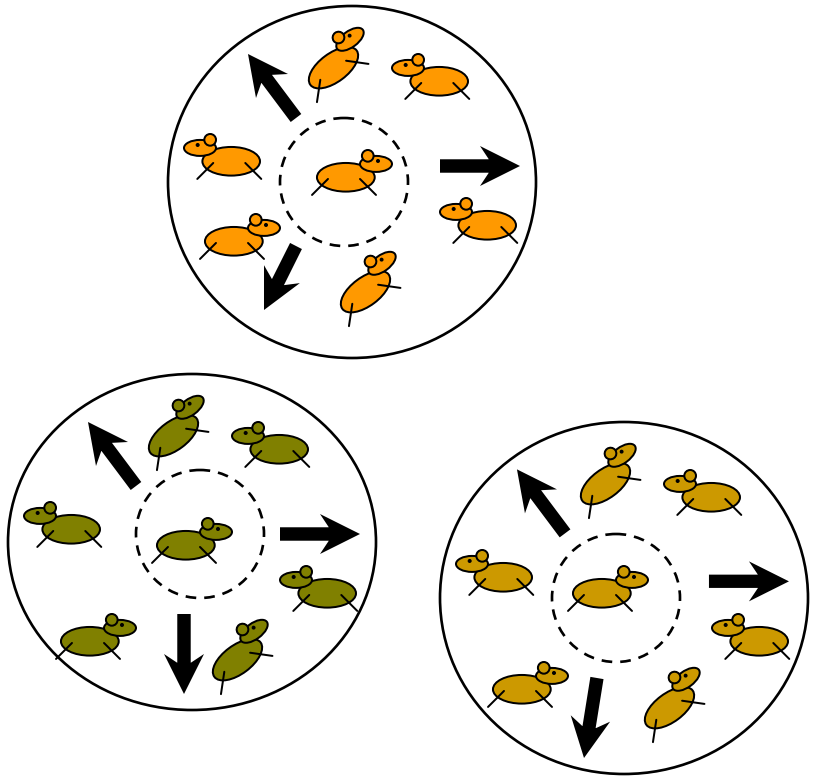


American pika

- Fragmented distribution tracks western mountains
- Fossil record – dates to last glacial period (~30 ka)
- Populations once found at lower elevations

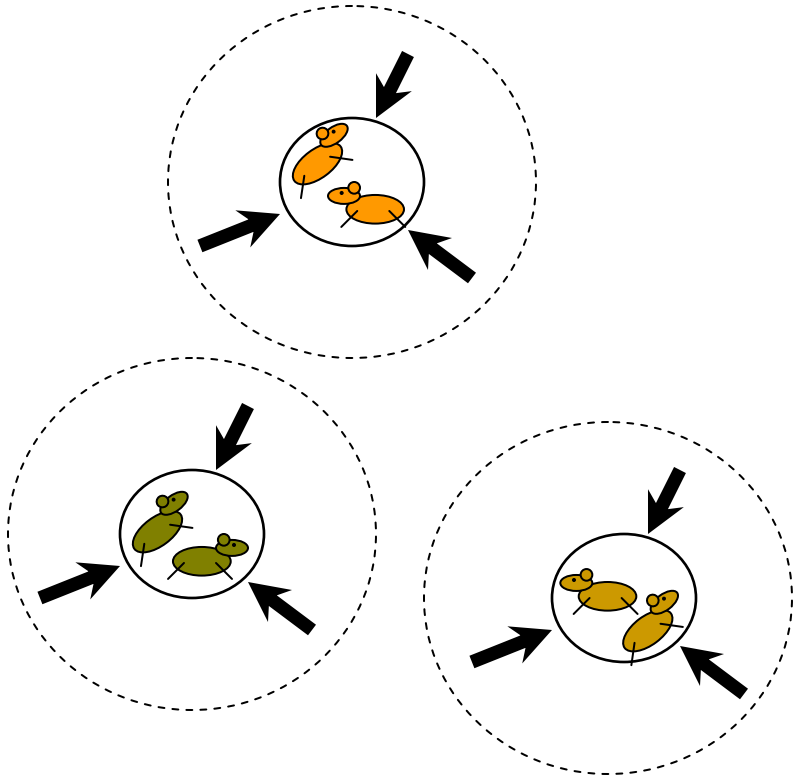
Distribution strongly influenced by climate

Glacial periods – population expansion and potential contact



Distribution strongly influenced by climate

Interglacial periods – population retraction and fragmentation

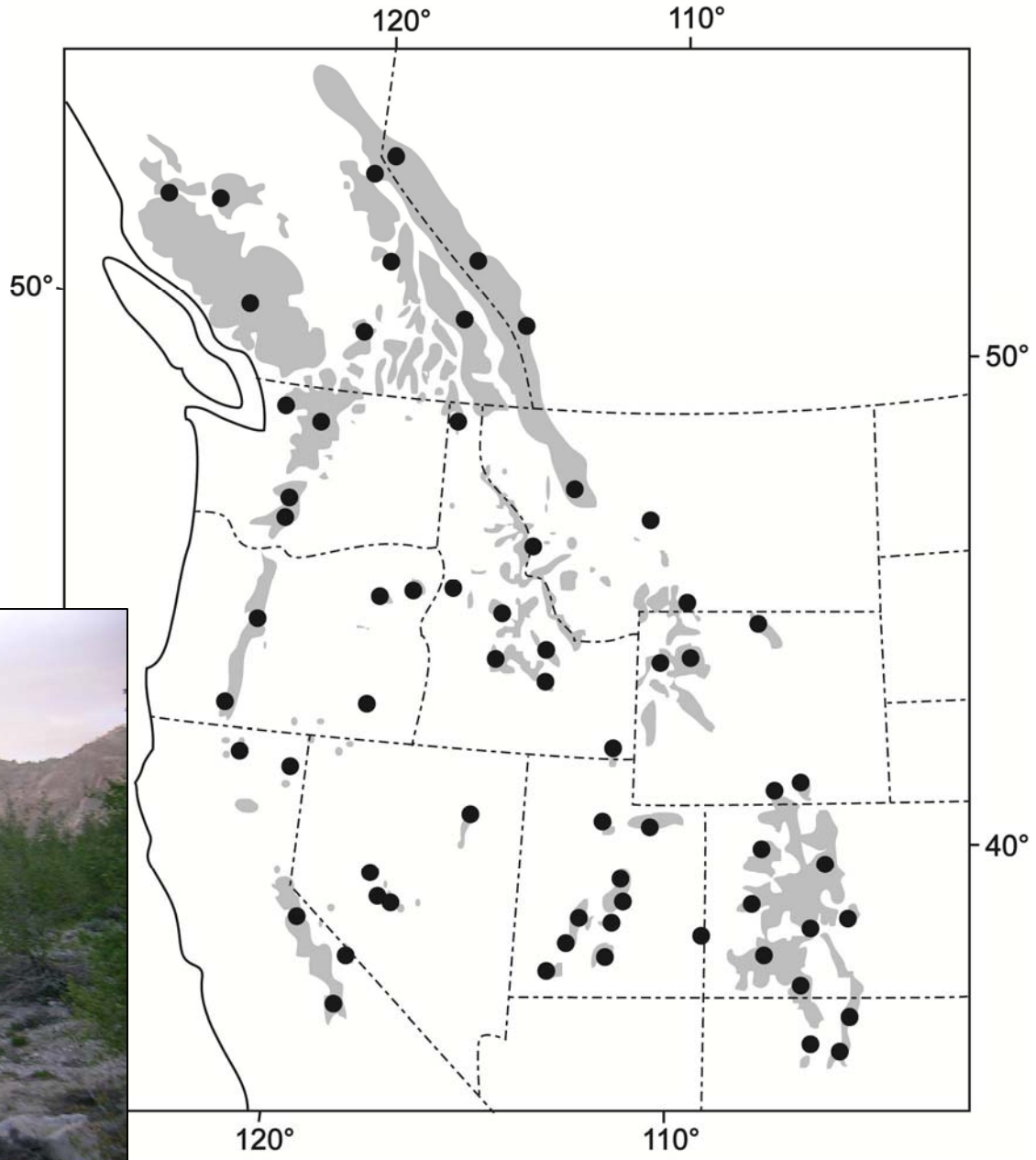


Question

What are the consequences of climate-driven range fluctuation for patterns of diversity?

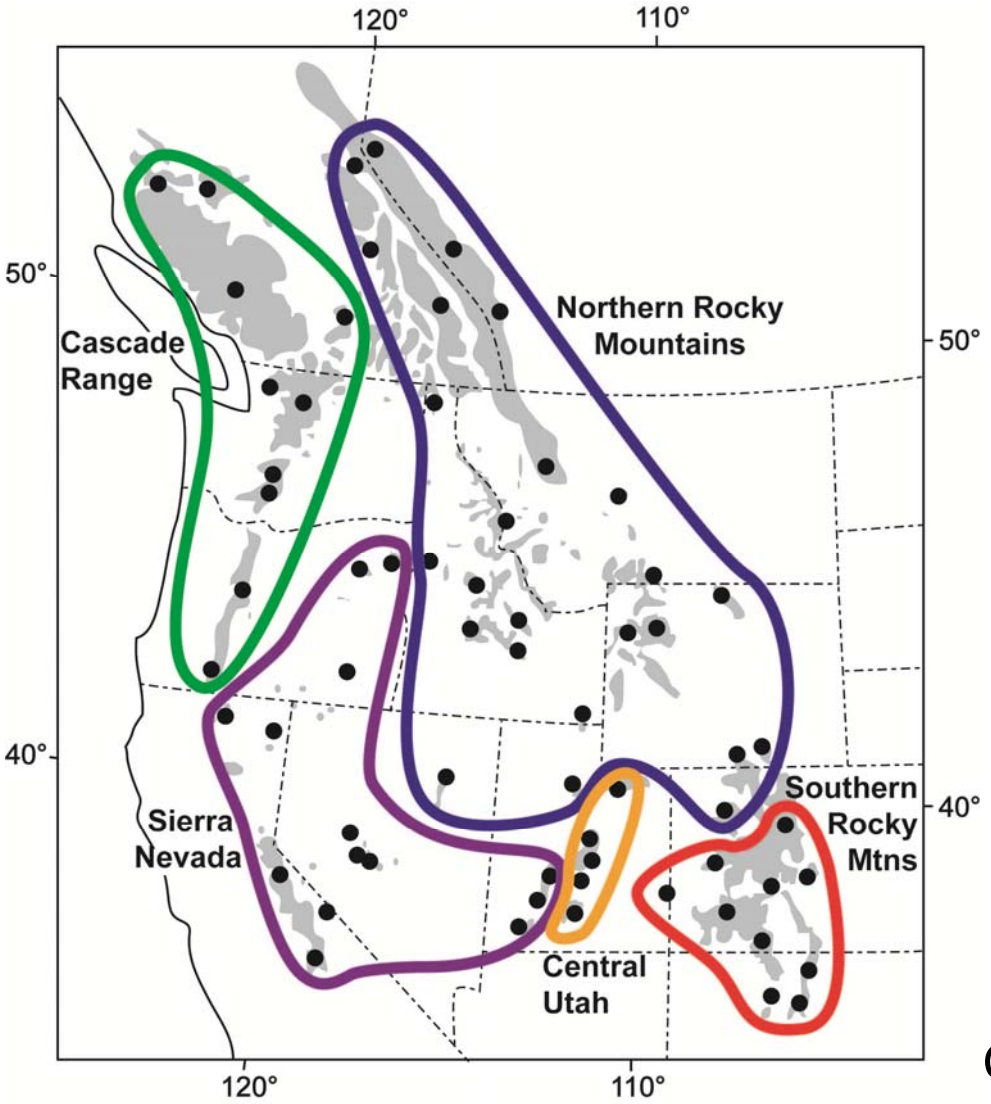
Sampling

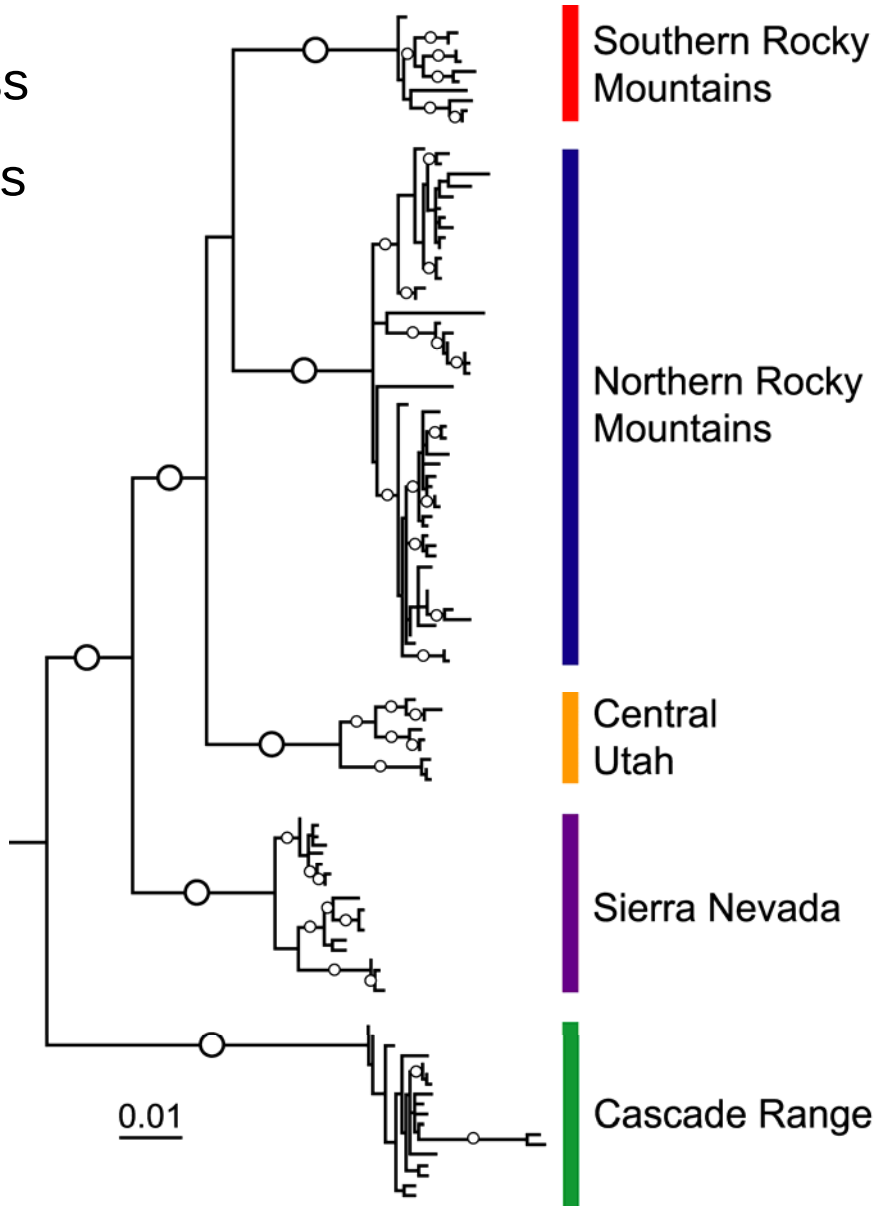
- 232 pikas
- 64 localities
- mtDNA sequencing



mtDNA lineage distributions:

- few lineages; does not reflect patchiness
- associated with major mountain systems





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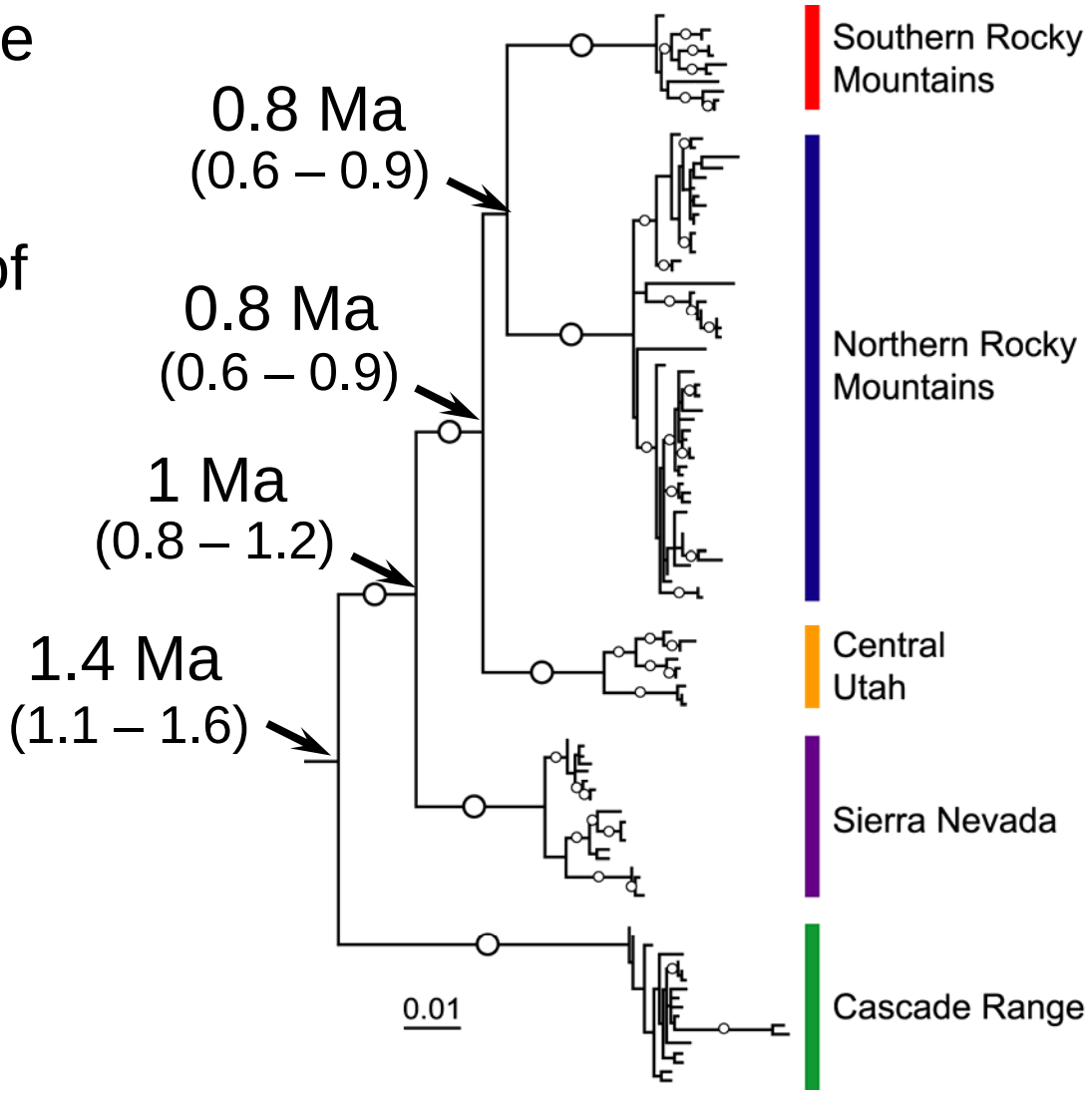
How old are mtDNA lineages?

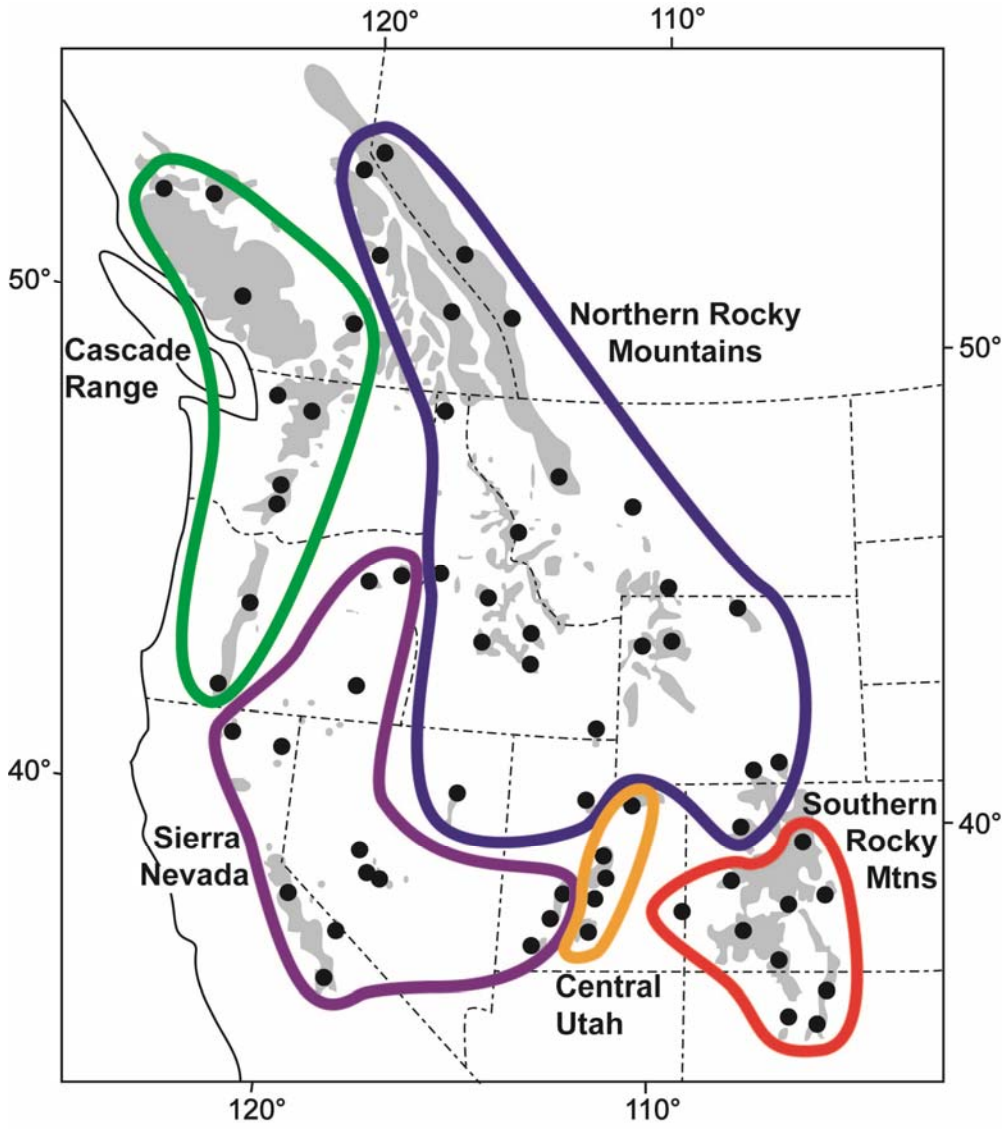
- Lineages span multiple glacial cycles
- Sequential episodes of divergence

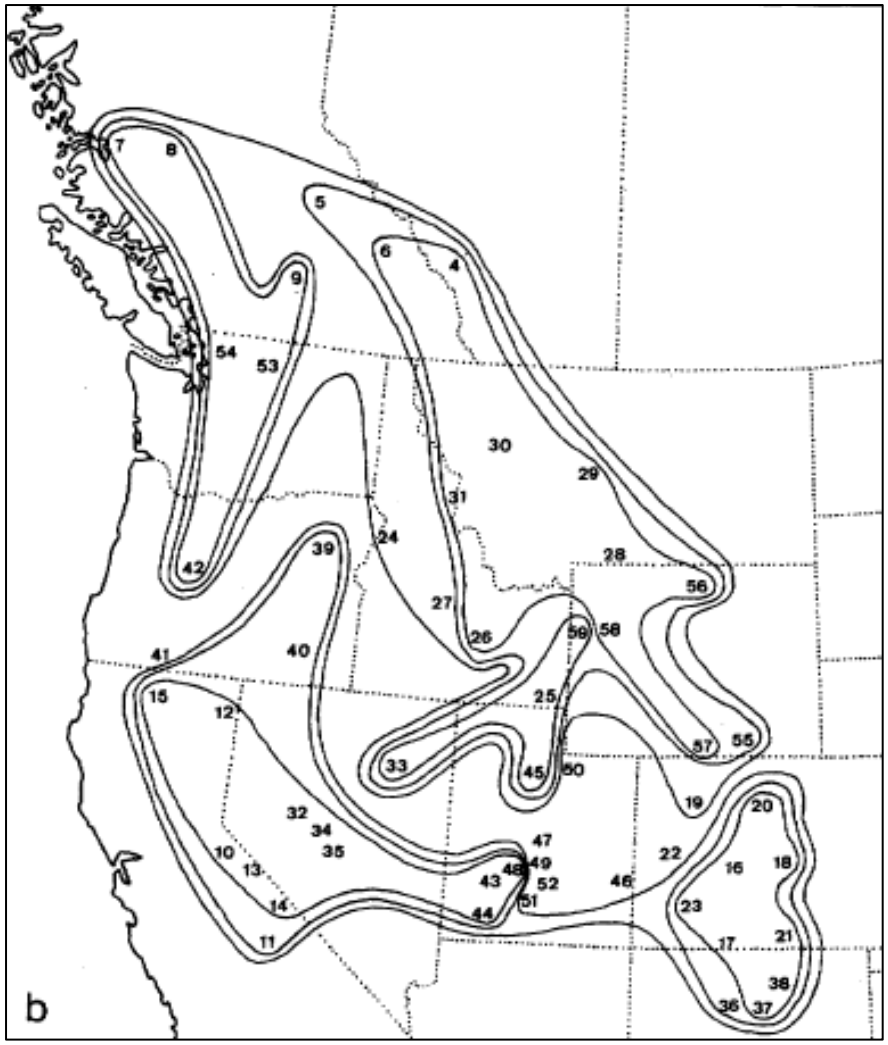


Question

Are regional subgroups on independent evolutionary trajectories?

Concordance with nuclear markers - allozymes



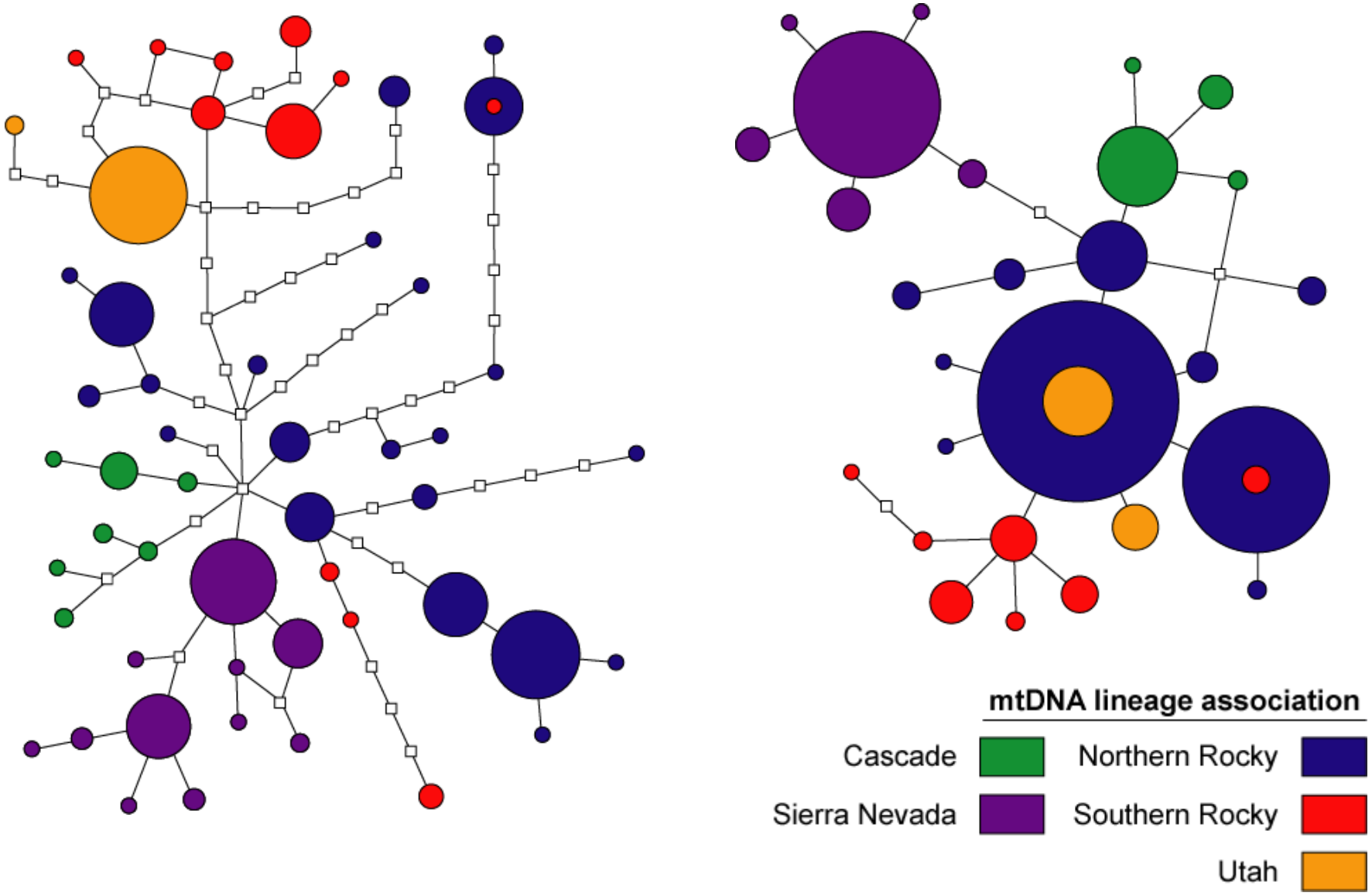


Hafner and Sullivan 1995

Sequence data from 2 nuclear introns:

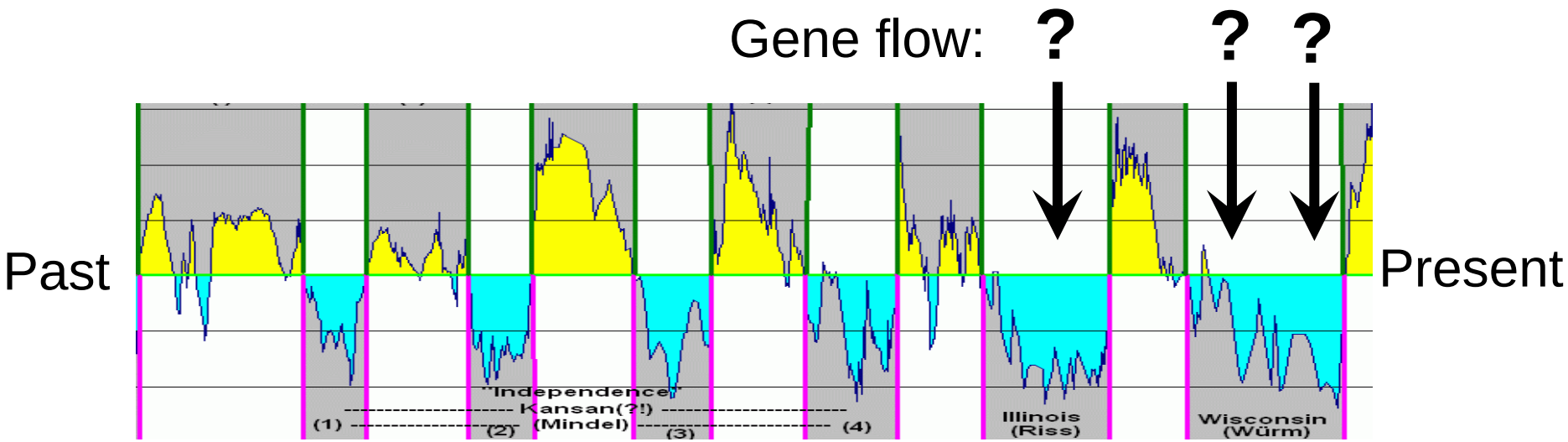
PRKCI (~660 bp; *N* = 139)

MGF (~ 550 bp; *N* = 148)



Do nDNA sequences retain signature of secondary introgression?

- Simulations of alternative population histories that invoke gene flow during different glacial episodes



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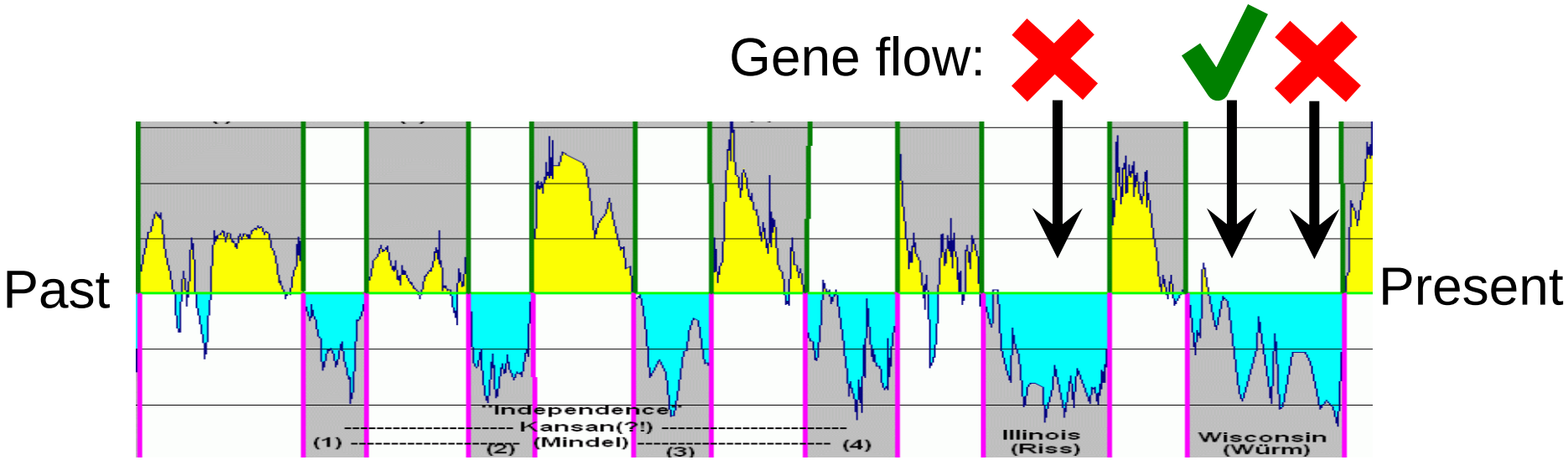


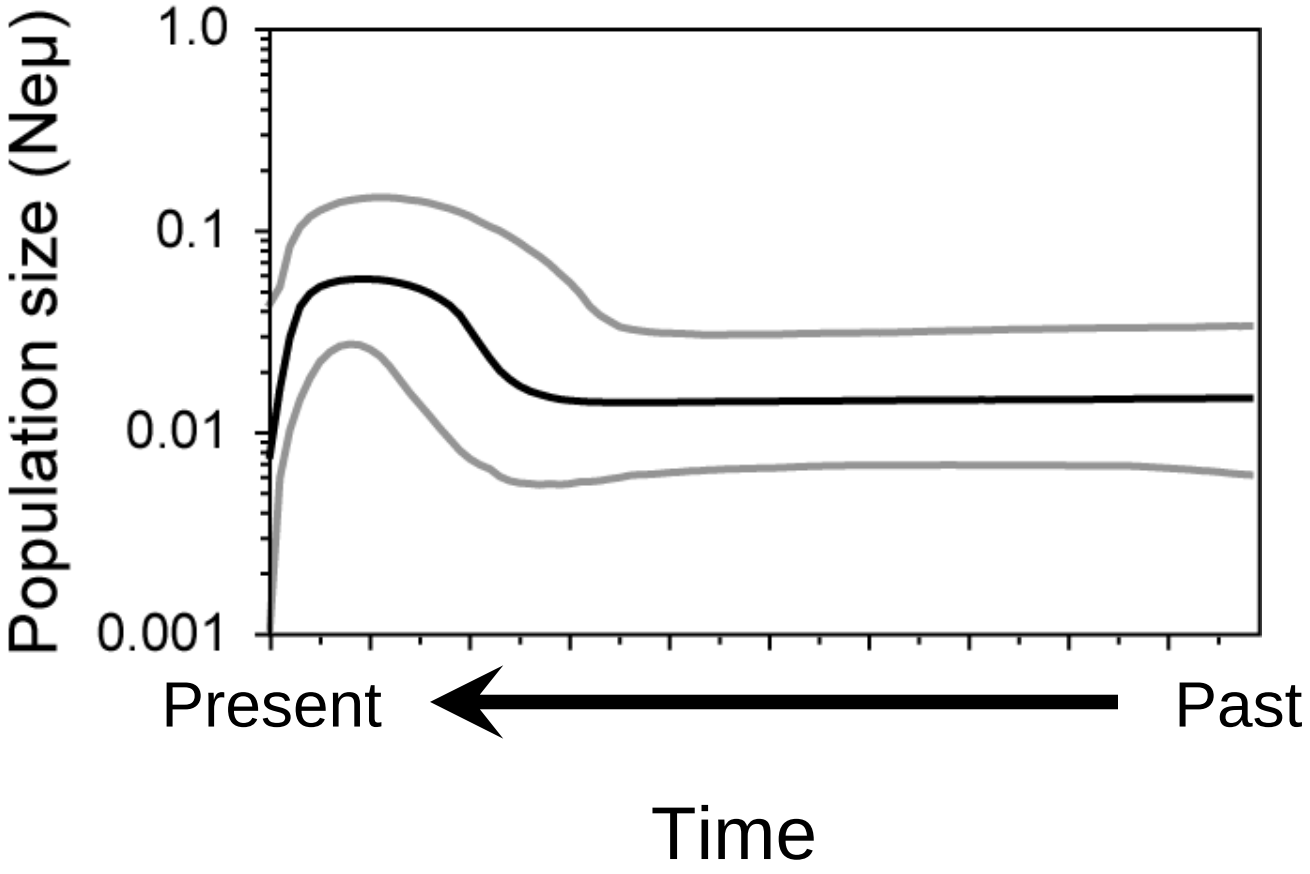
- support for secondary introgression at nuclear loci

Question

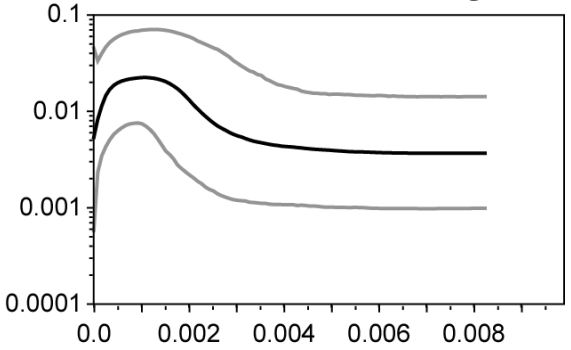
What are the consequences of range fluctuation for long term effective population size?

Did historical fluctuations in population distributions translate into changes in effective population size?

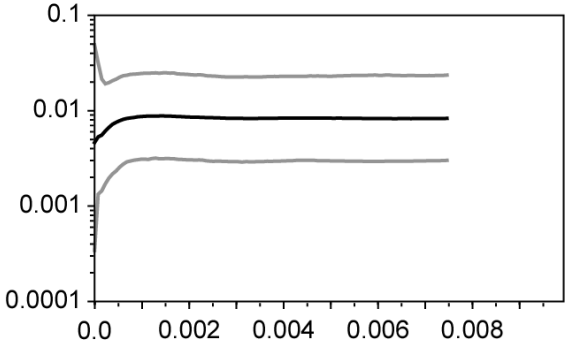
Skyline Plots - assess change in population size over time

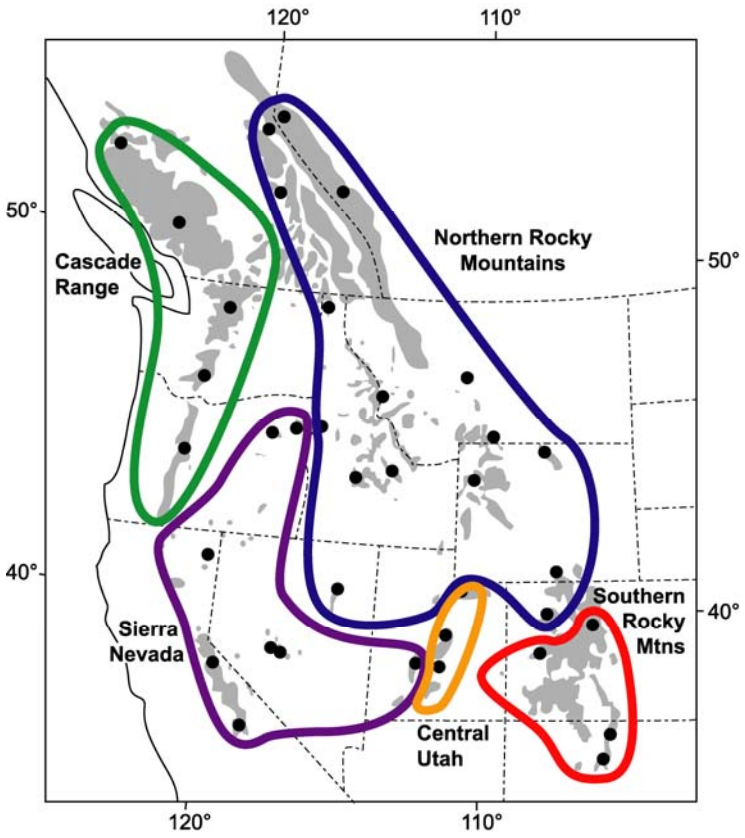


Cascade Range

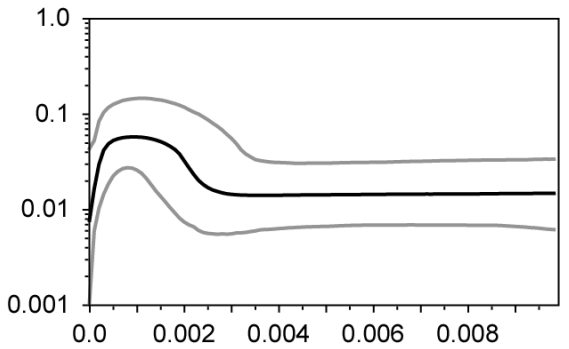


Sierra Nevada





Northern Rockies



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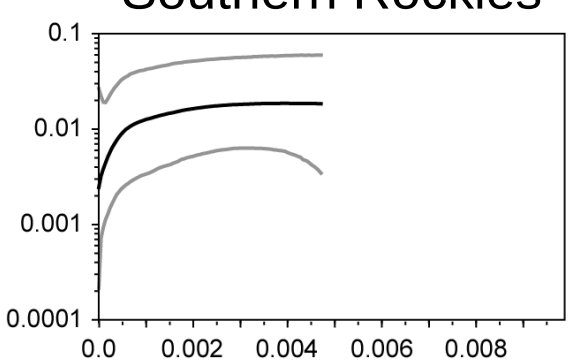
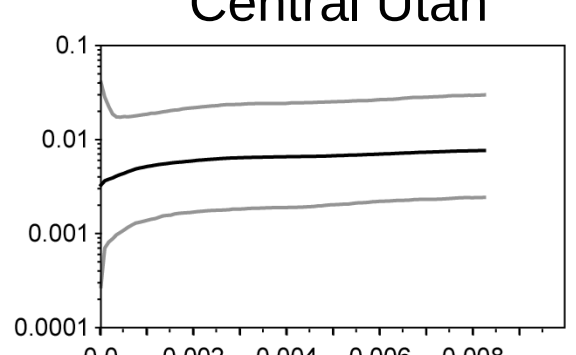


Central Utah



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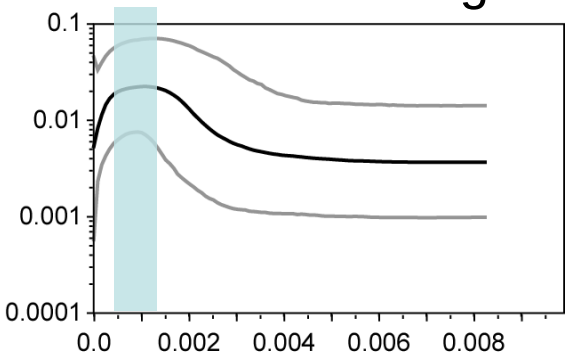
Cascade Range



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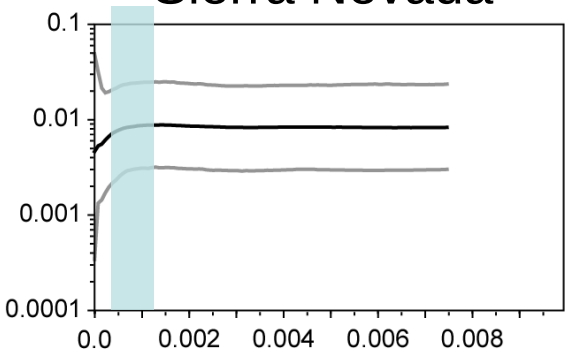

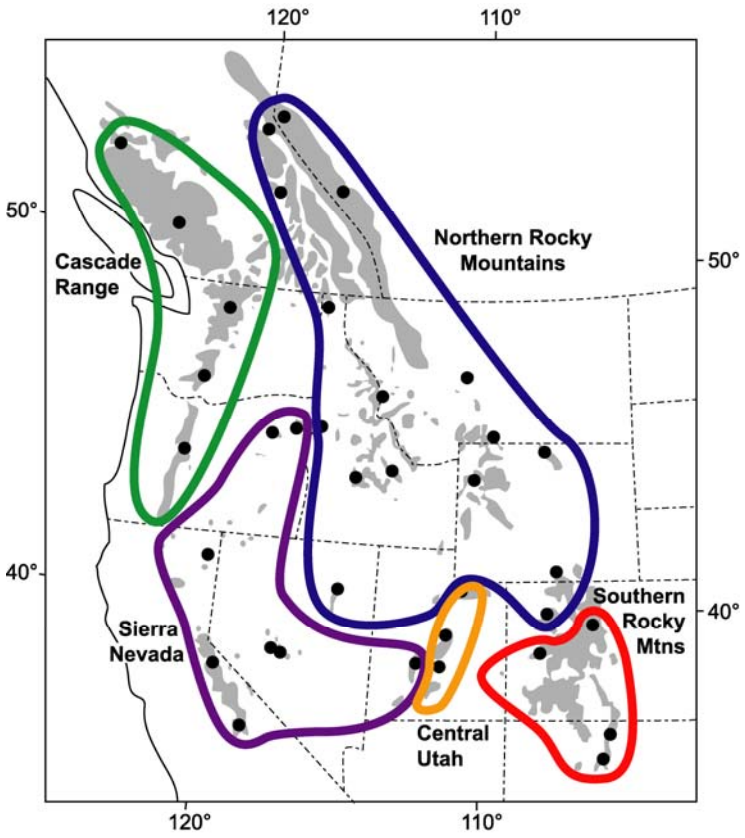

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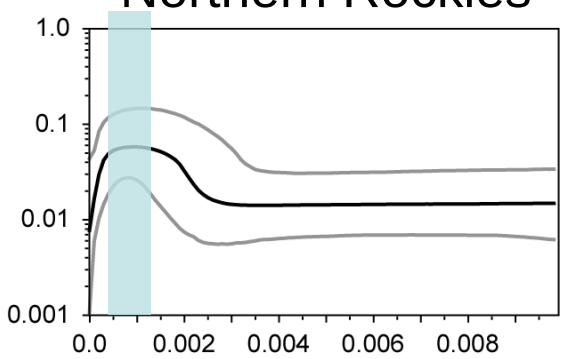

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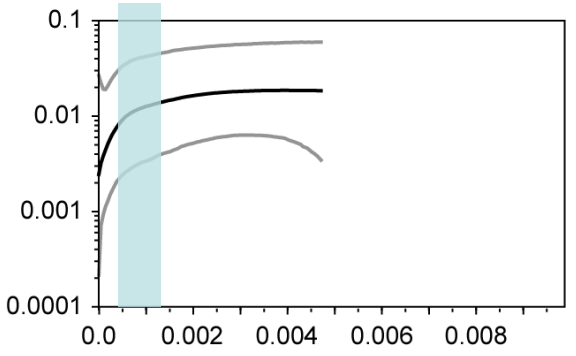

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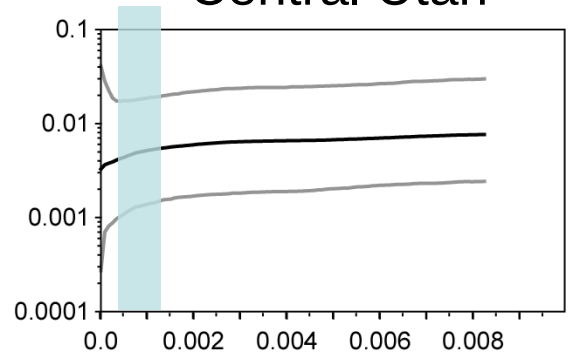

Skyline results:

Post-glacial decline (all lineages)

Pre-glacial growth (northern lineages)

Galbreath et al. 2009 Evolution

What have we learned?

1. Range fluctuation and patterns of diversity
2. Age of diversity
3. Independence of regional populations
4. Range fluctuation and effective population size
5. Considerations for the future