

Spruce beetle in the San Juans: *spatial patterns and observations from 2012*



David K. Scott
Biogeography Lab
Graduate Degree Program in Ecology
Colorado State University

The current outbreak is...



...stand replacing in many areas.

The current outbreak is...



...unusually severe.

The current outbreak is...



...affecting treeline locations.

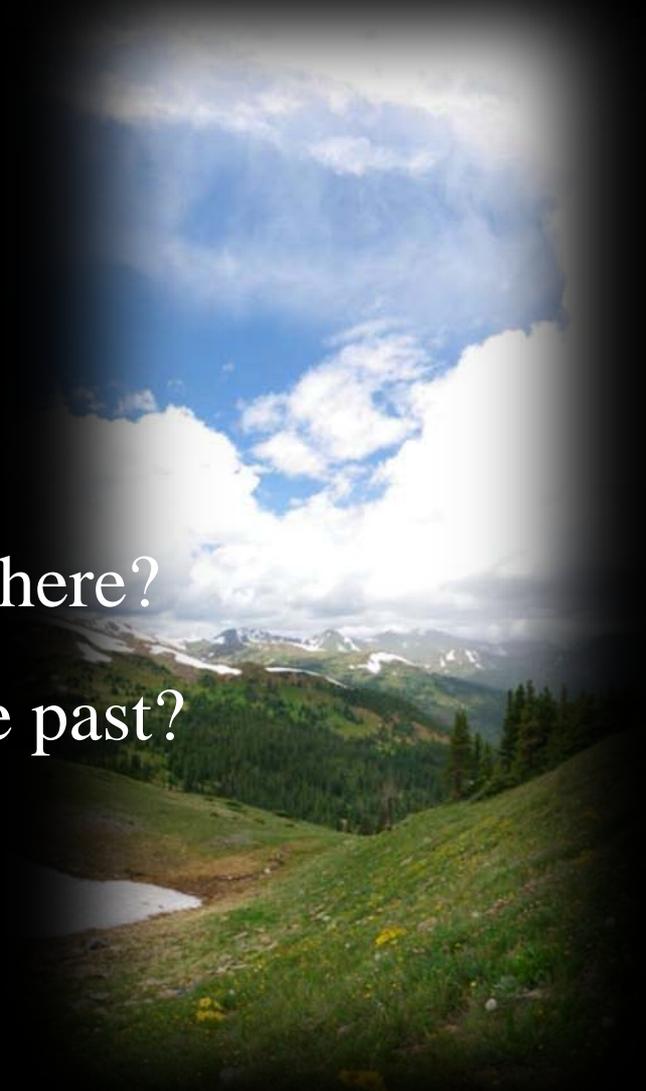
The current outbreak is...



...still active.

Motivations

- Where did outbreaks initiate?
- Which outbreaks became severe?
- Why *didn't* outbreaks occur everywhere?
- How have outbreaks occurred in the past?



Background

- Detected by aerial survey in 2004
- Tree ring data suggest some beetle activity began late 1990s/early 2000s
- Major avalanche cycle in January 2005 may have played a role
- Has affected $> 800 \text{ km}^2$



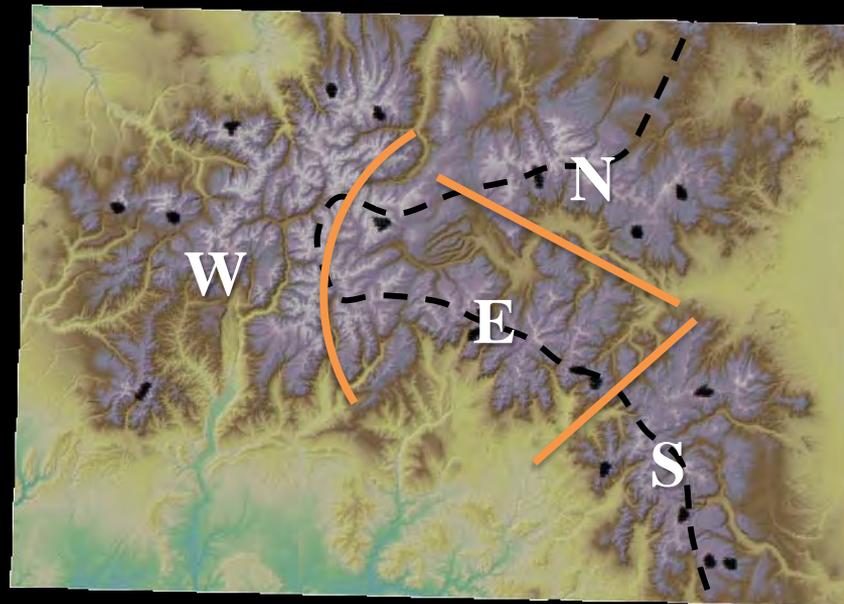
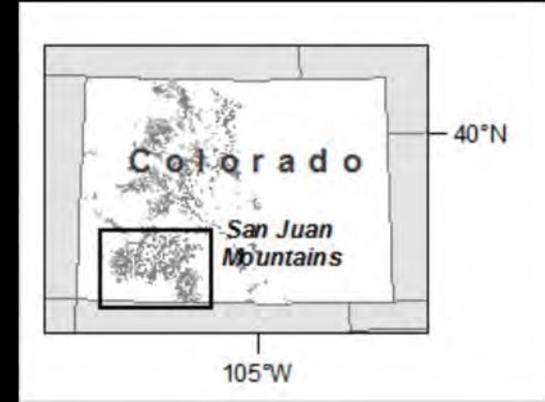
Data

- Plot surveys 2012 (19 valleys, 792 plots, 10,600 trees)
- Aerial detection surveys
- Tree rings (5 valleys & 8 droughty sites, >1200 trees)
- PRISM interpolated weather/climate data

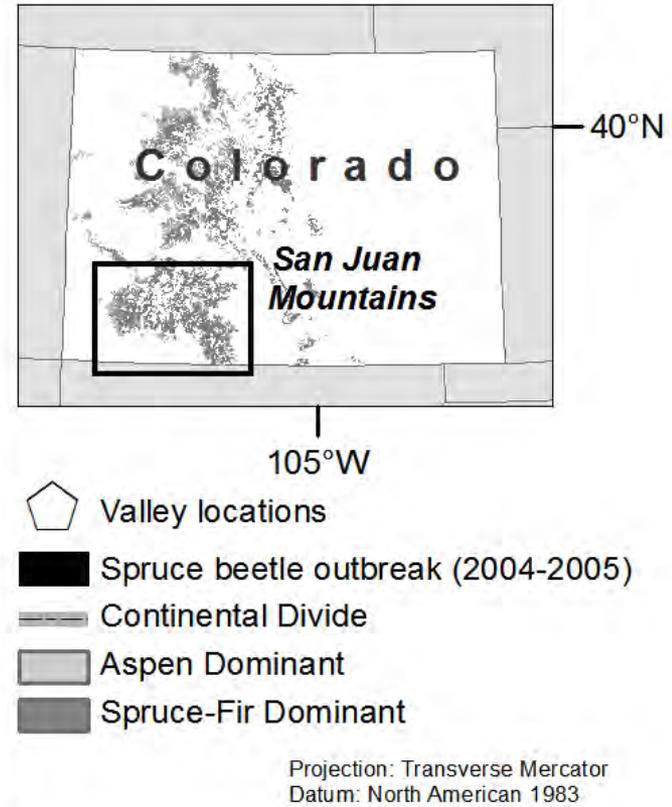
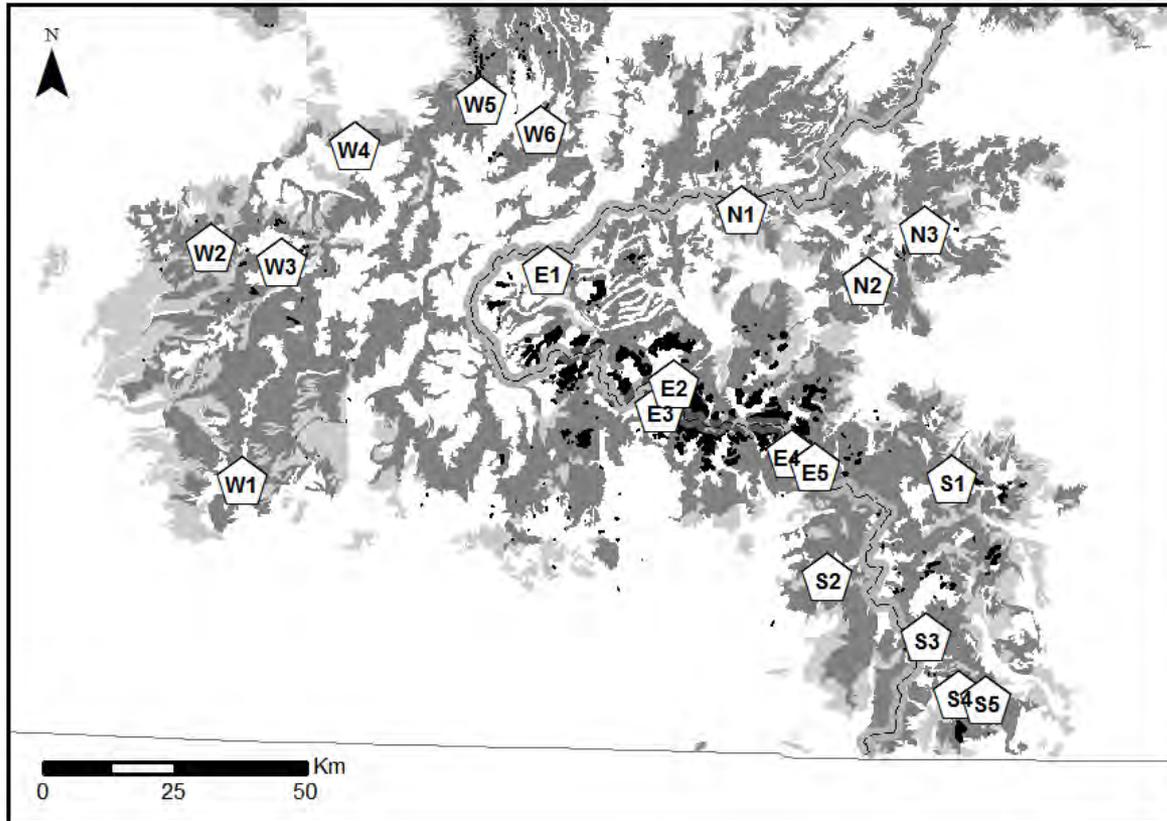


Geography

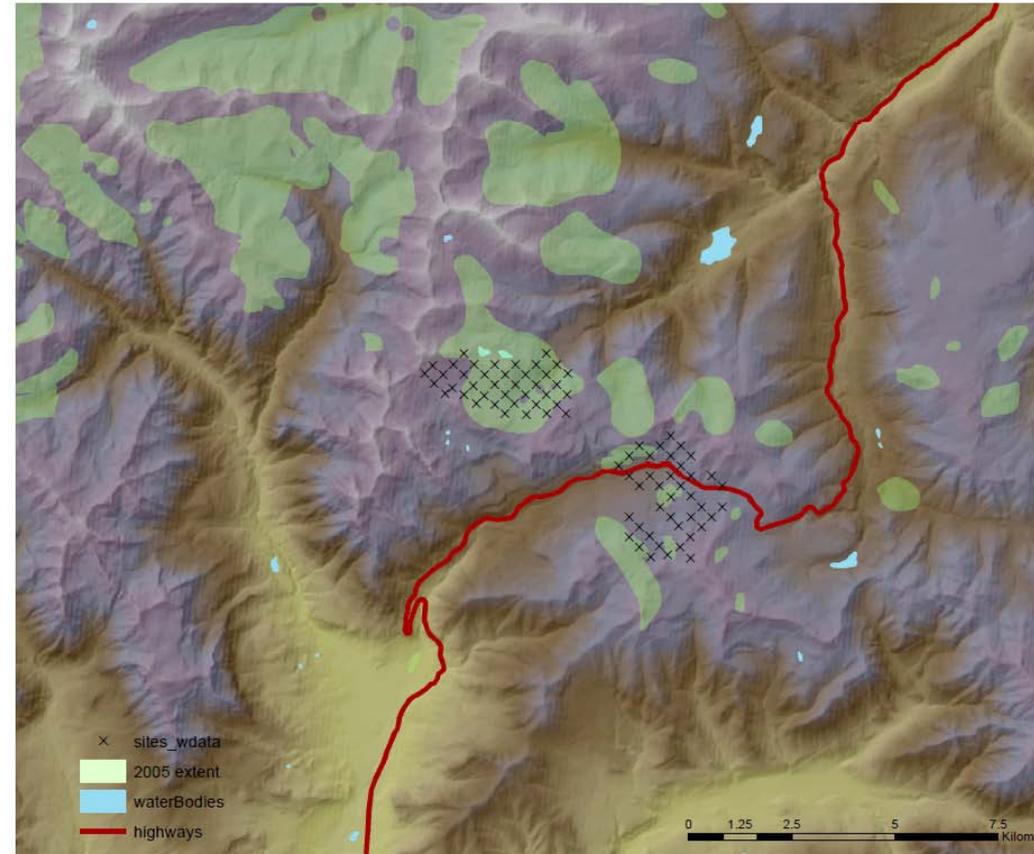
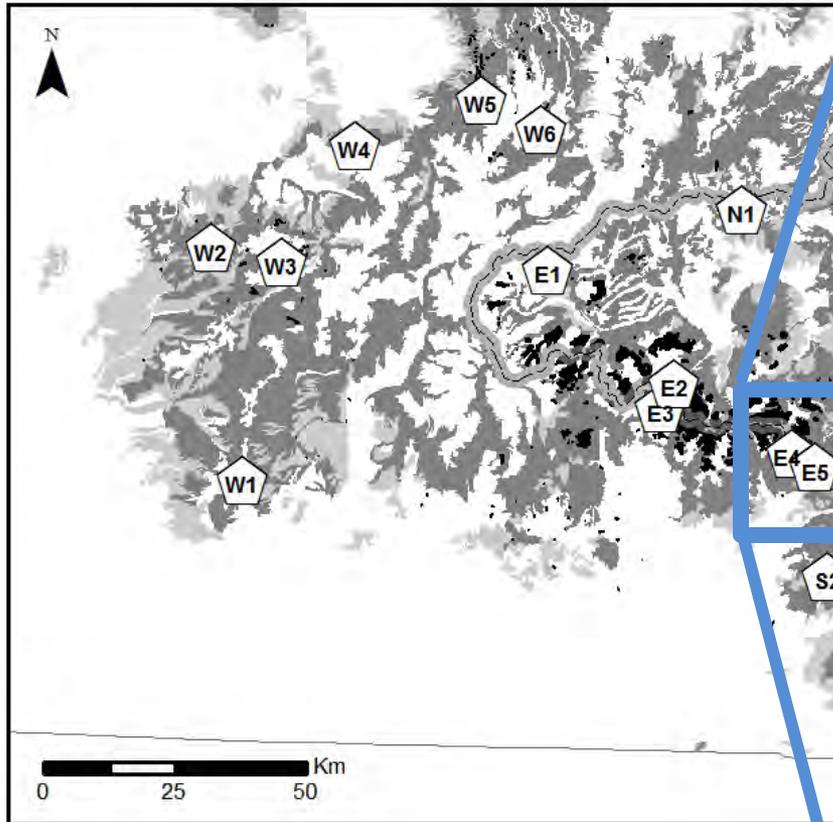
- Colloquial sub-regions



Sampling

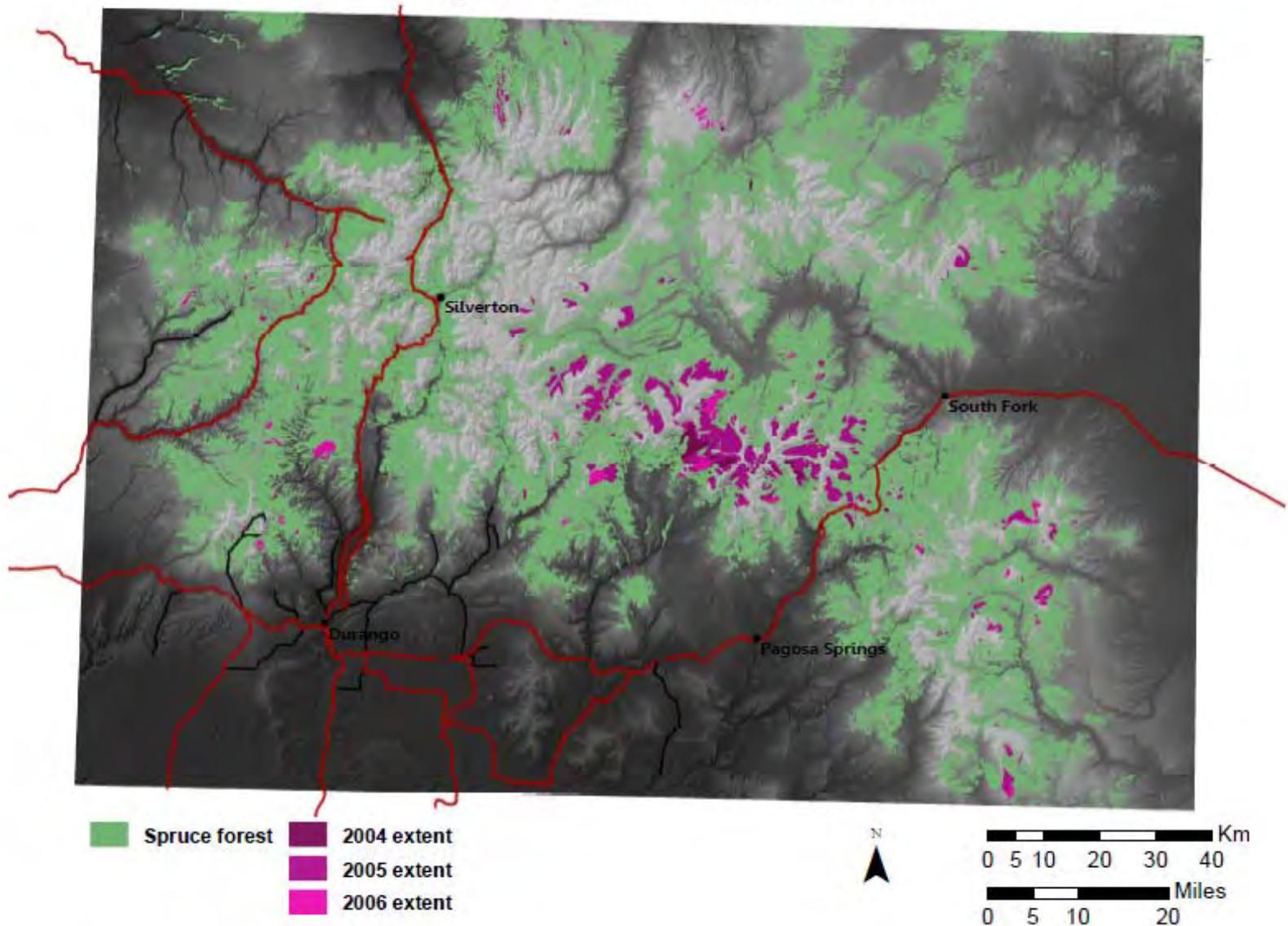


Sampling



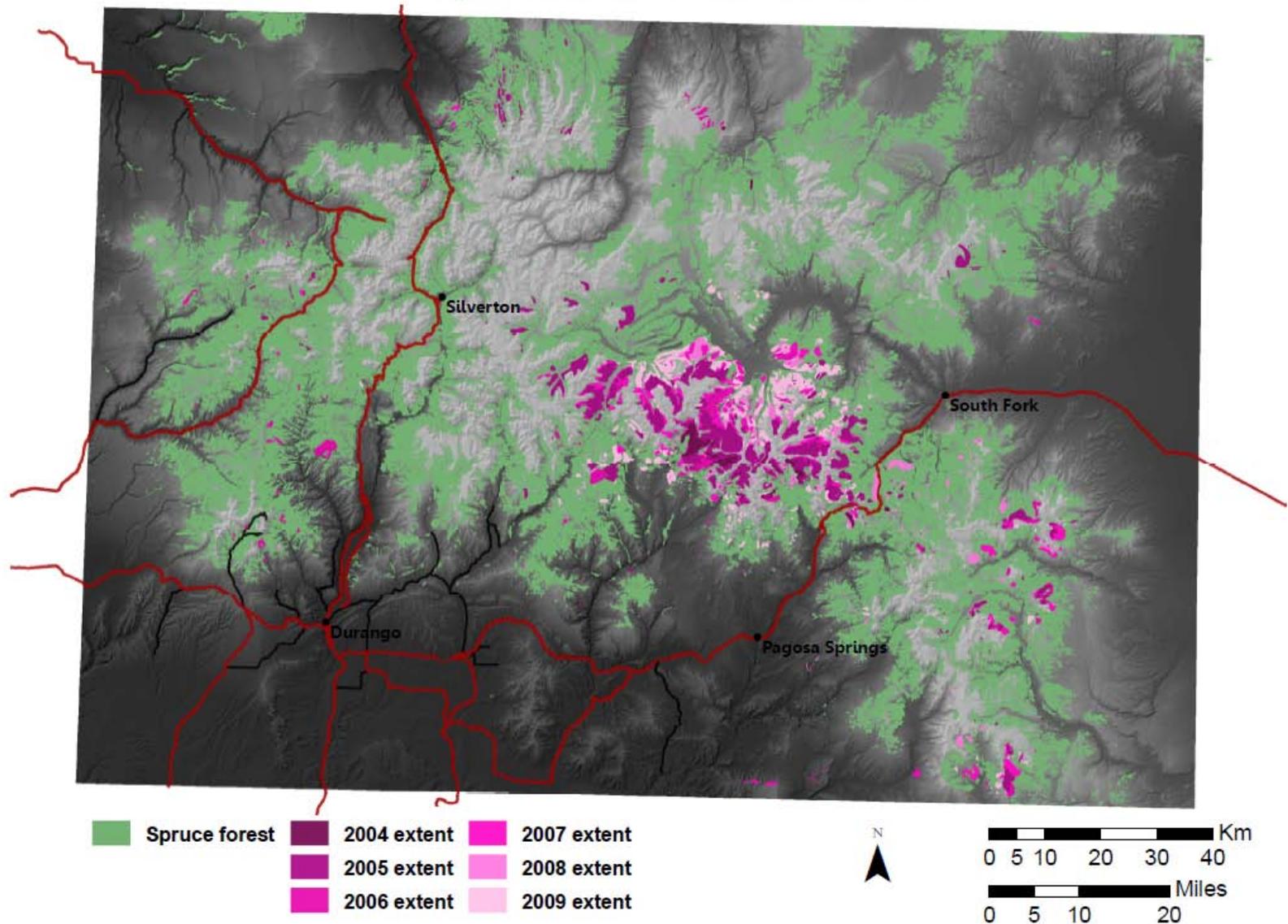
Where did outbreaks initiate?

Spruce beetle in the San Juans



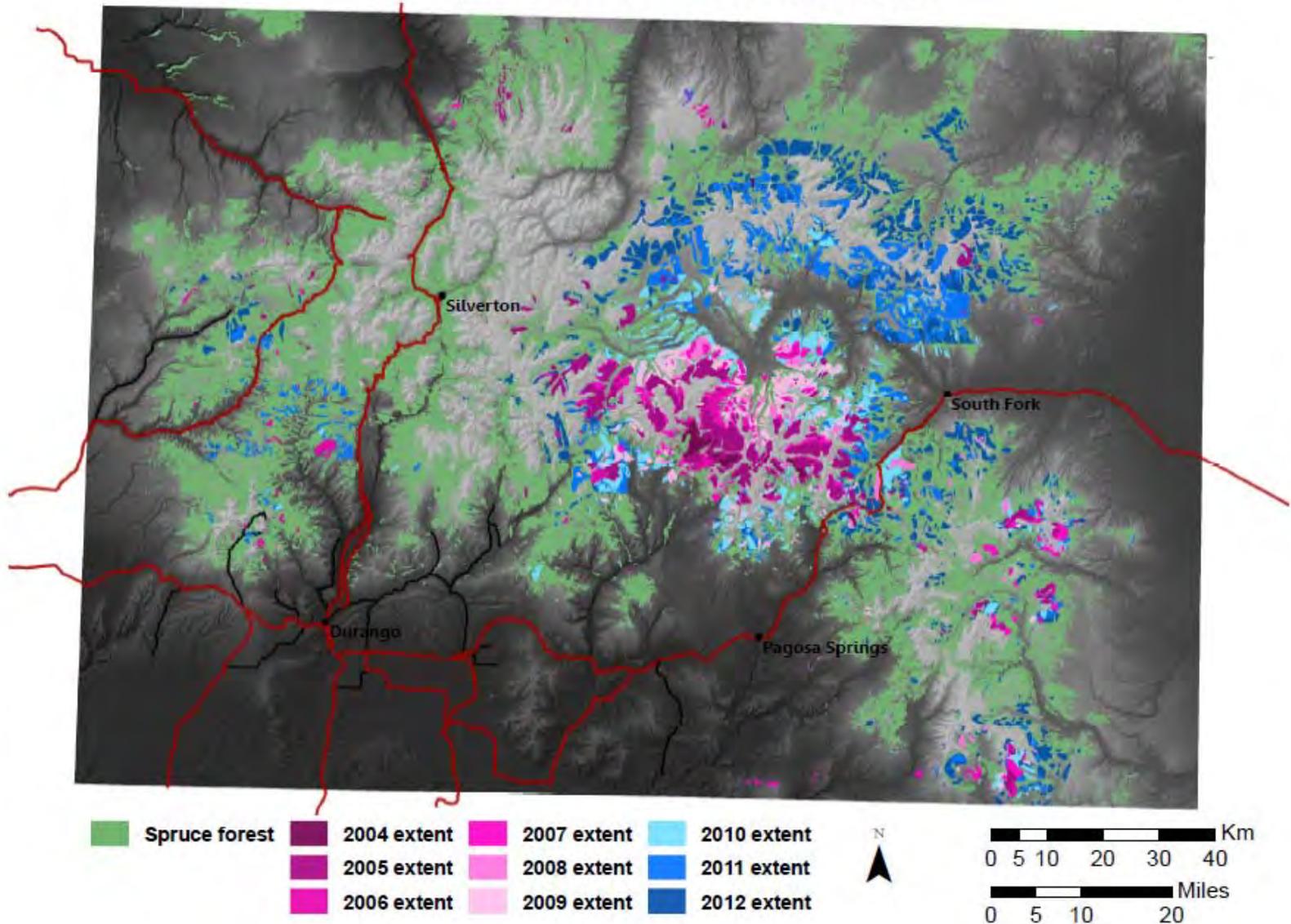
Where did outbreaks initiate?

Spruce beetle in the San Juans



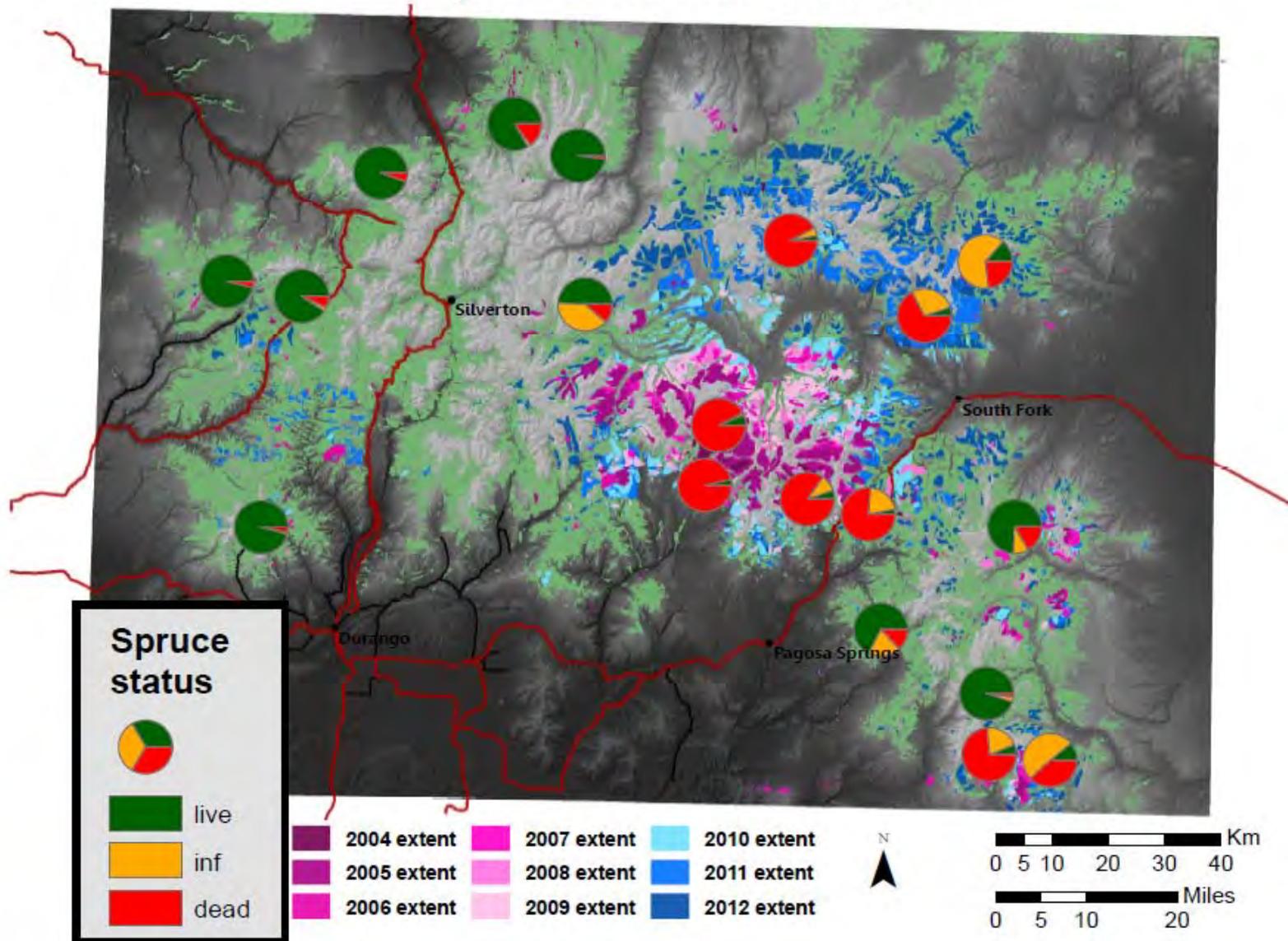
Where did outbreaks initiate?

Spruce beetle in the San Juans

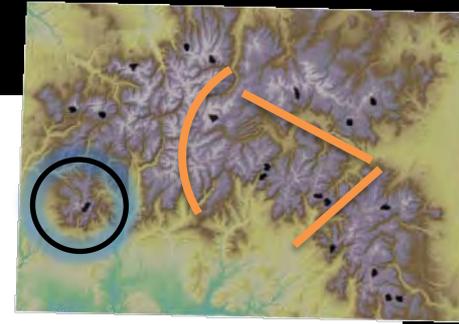


Which outbreaks became severe?

Spruce beetle in the San Juans

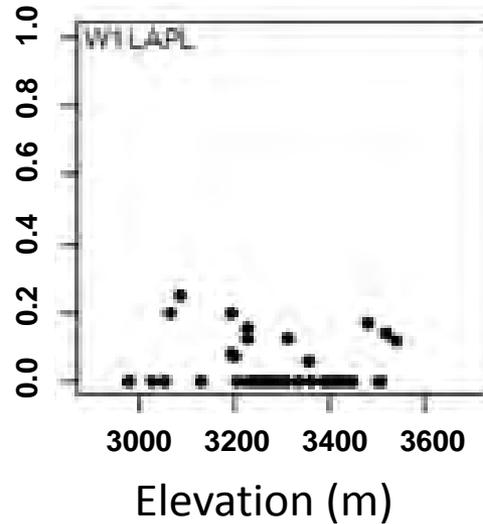


Which outbreaks became severe?



Snapshot of severity

Proportion of spruce basal area that is dead or infested

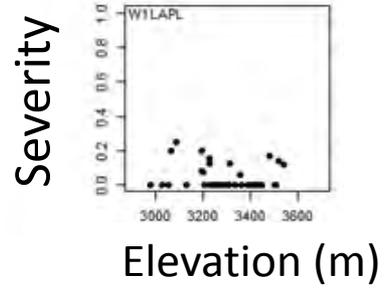
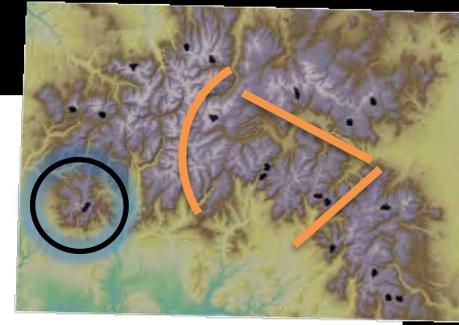


← ~ 100% of basal area affected

← ~ 50% of basal area affected

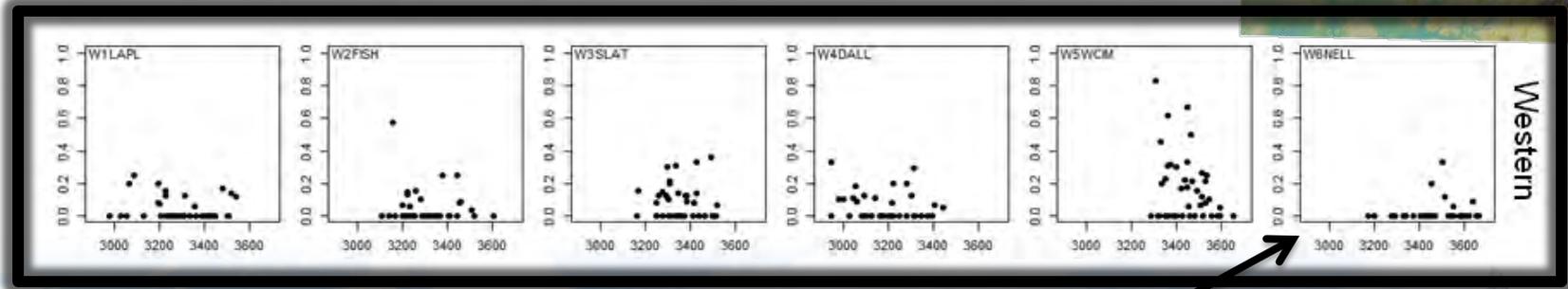
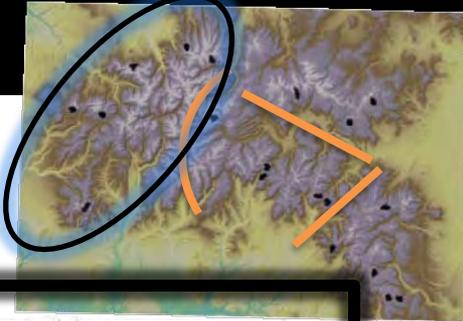
← ~ 0% of basal area affected

Which outbreaks became severe?



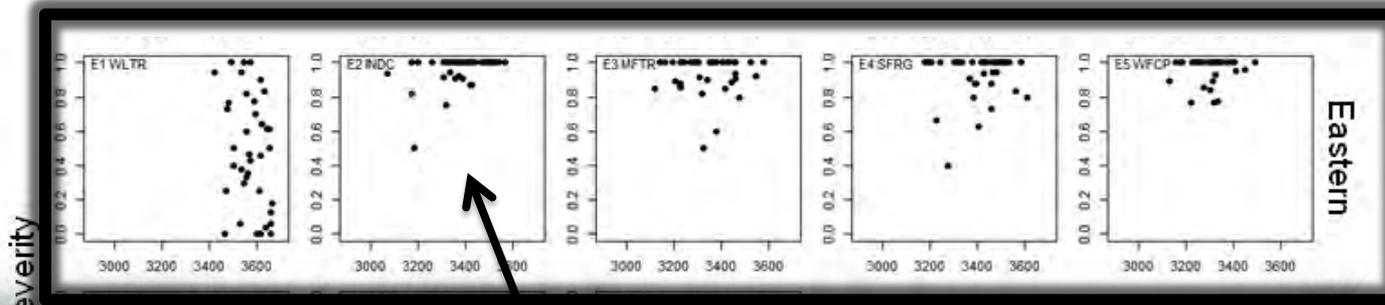
Which outbreaks became severe?

Proportion of PIEN basal area dead or infested

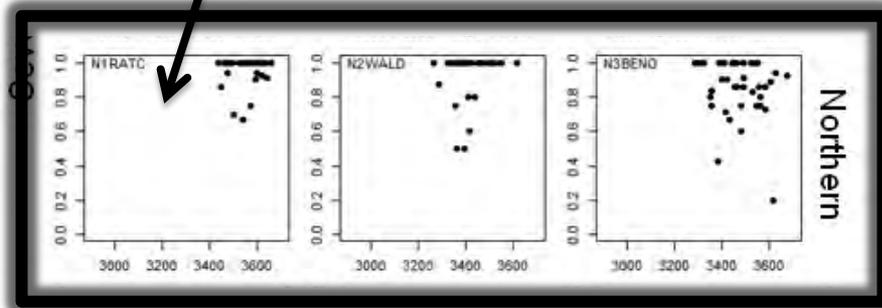


Which outbreaks became severe?

Proportion of PIEN basal area dead or infested

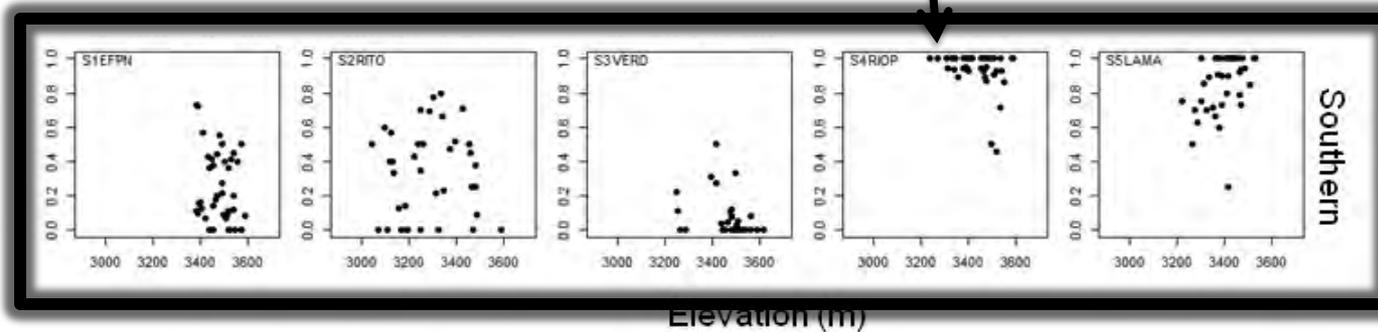
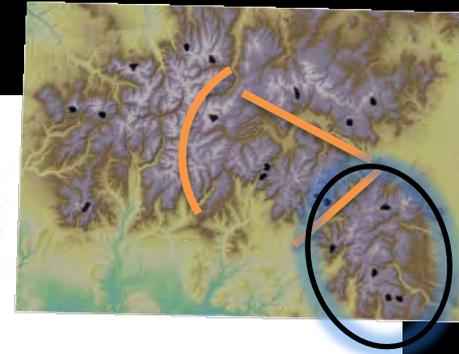


Which outbreaks became severe?



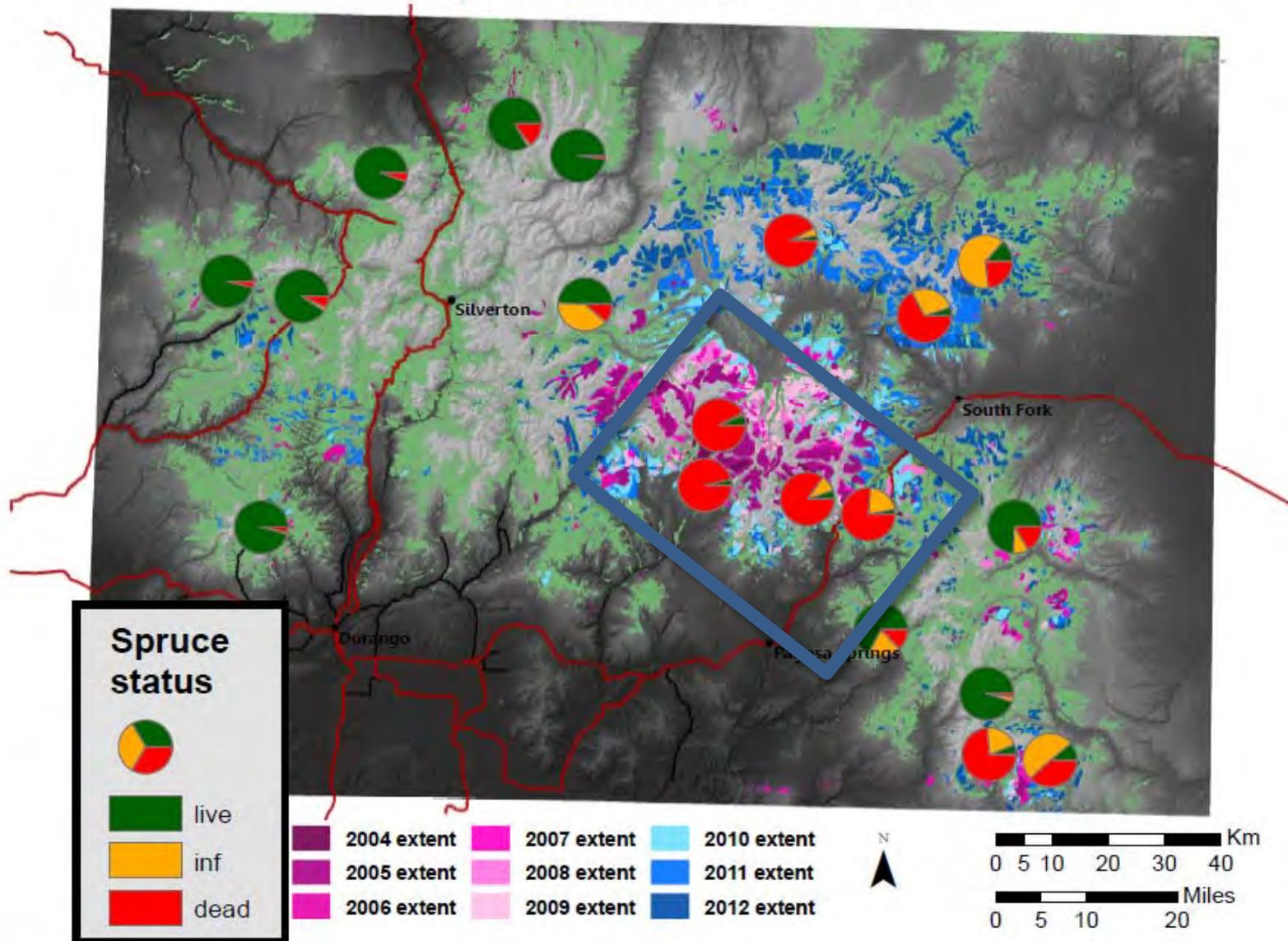
Which outbreaks became severe?

Proportion of PIEN basal area dead or infested



Which outbreaks became severe?

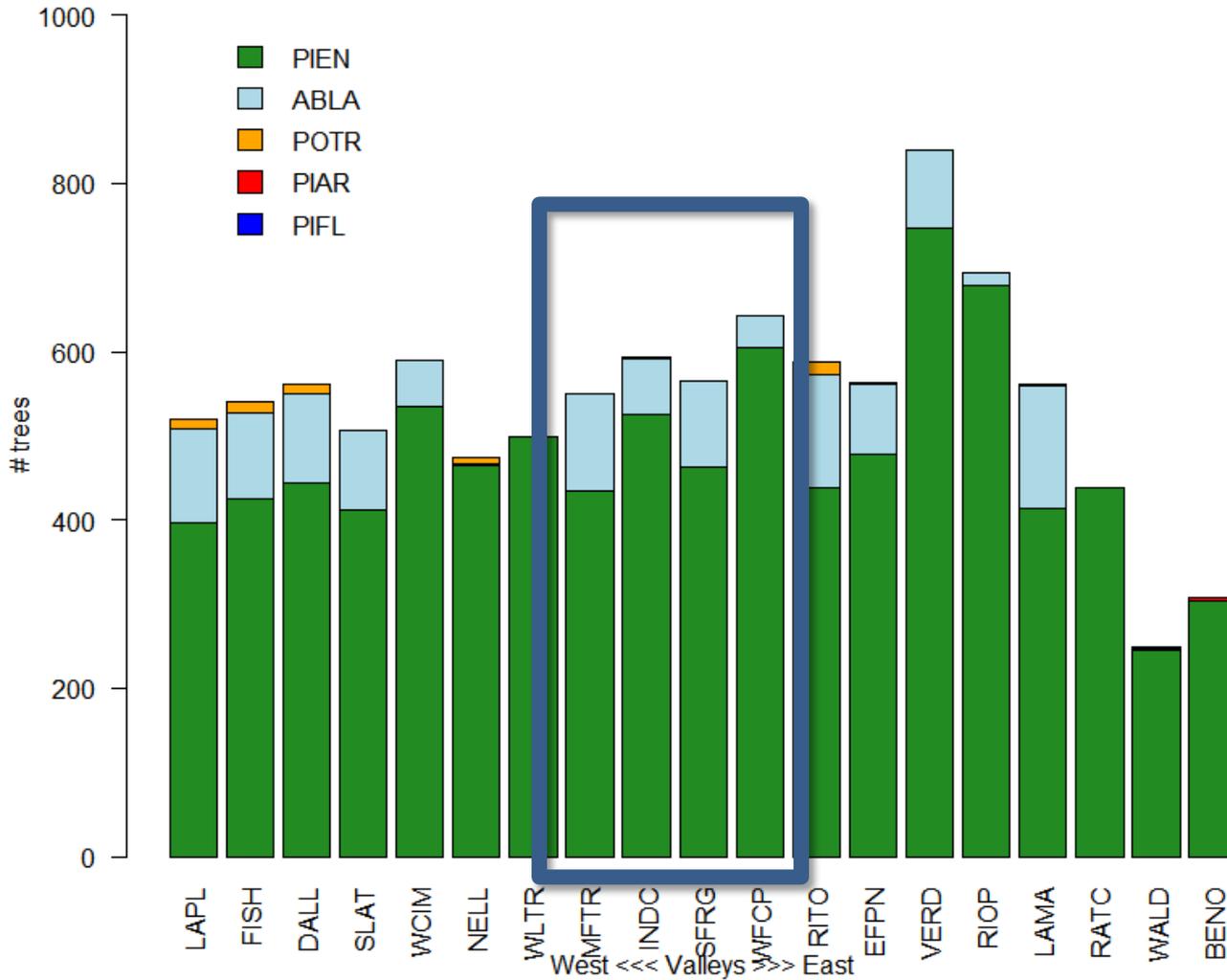
Spruce beetle in the San Juans



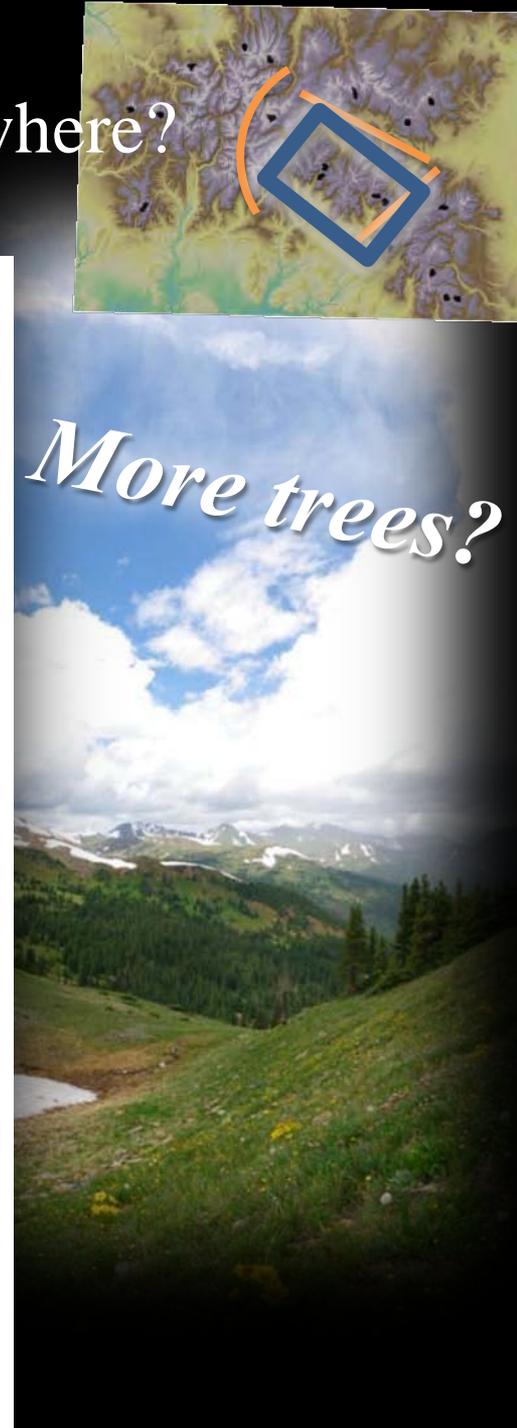
Why didn't severe outbreaks occur everywhere?



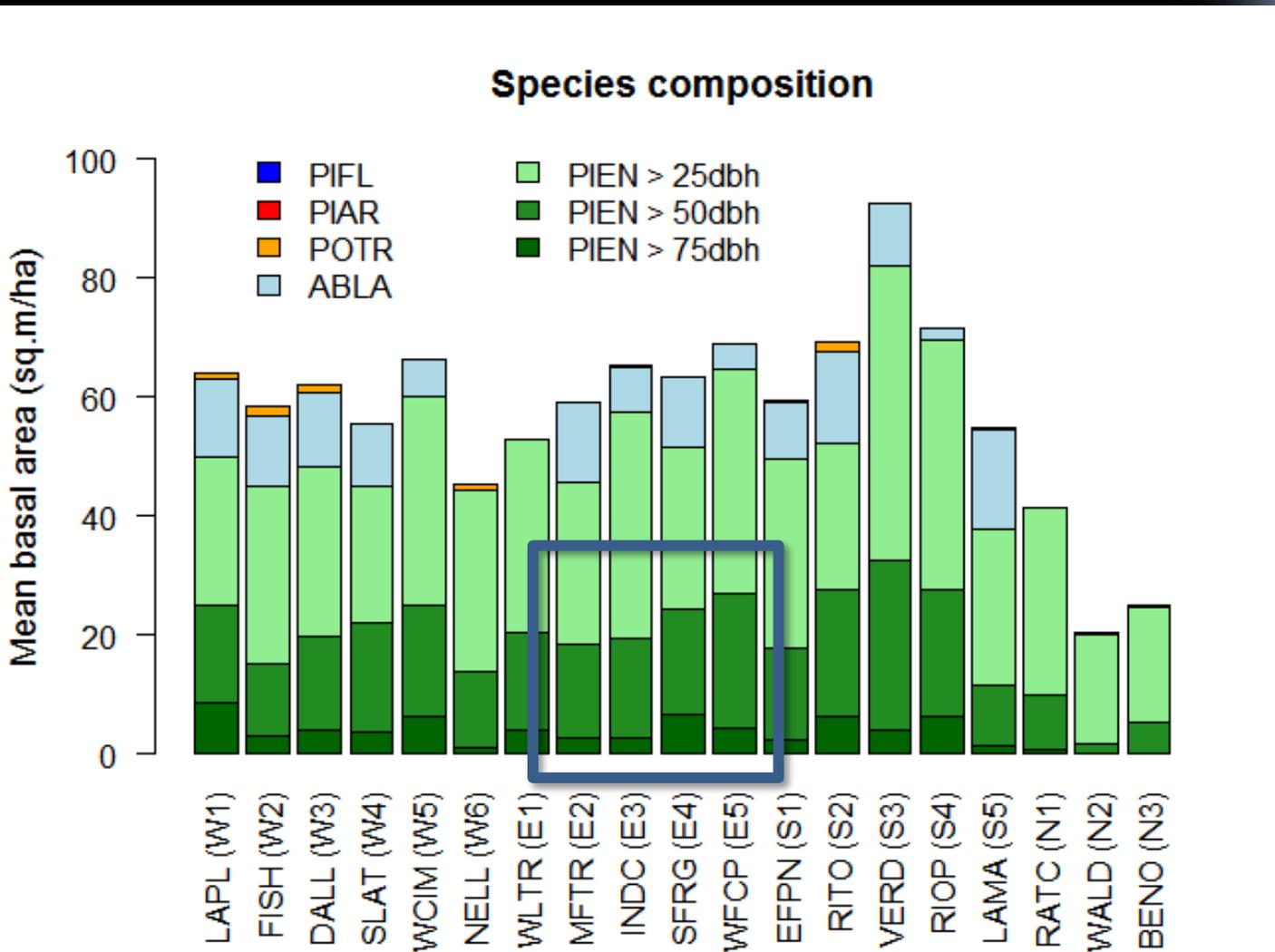
Tree Species Frequency



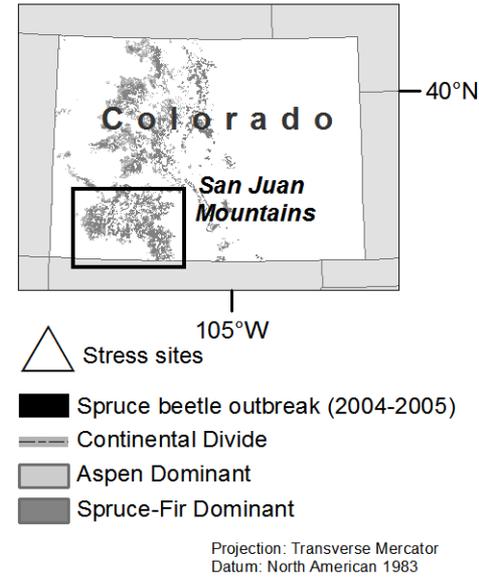
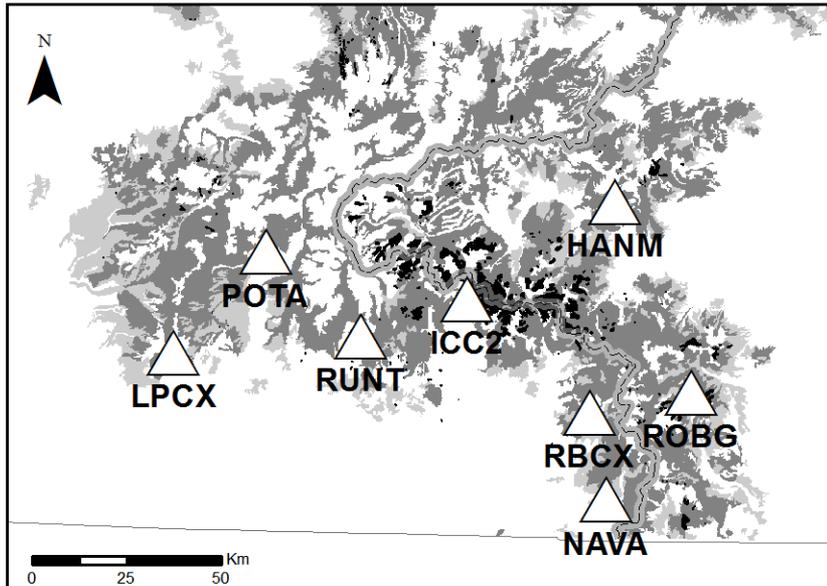
More trees?



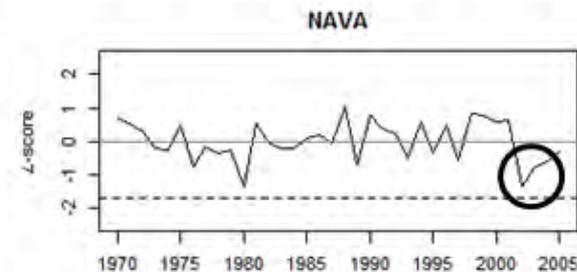
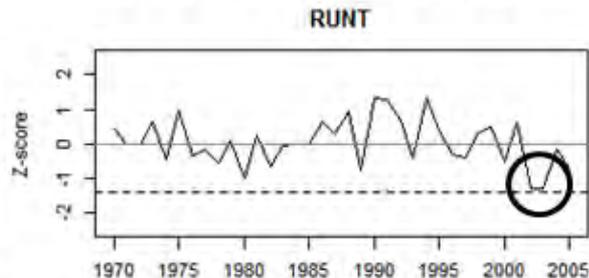
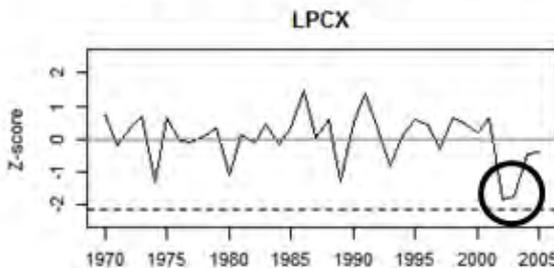
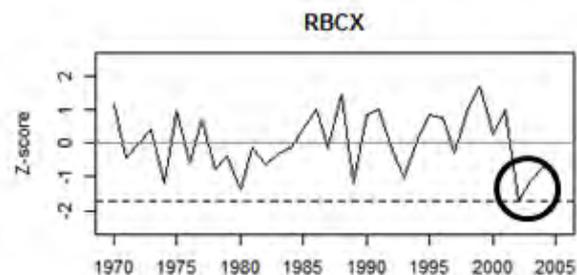
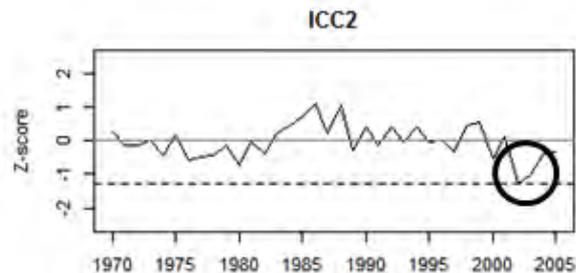
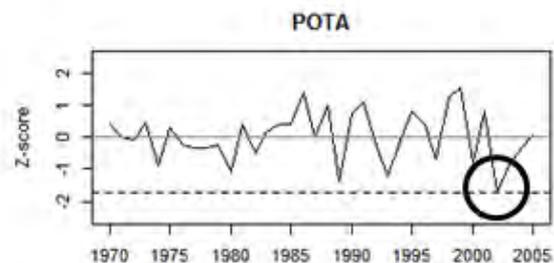
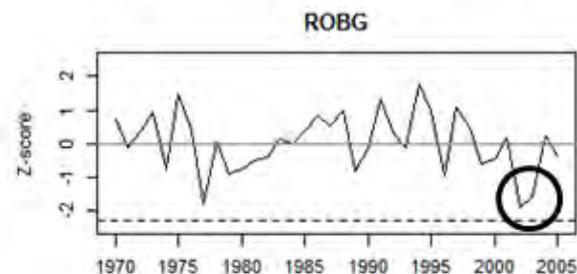
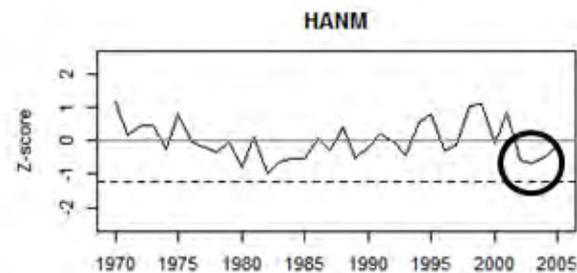
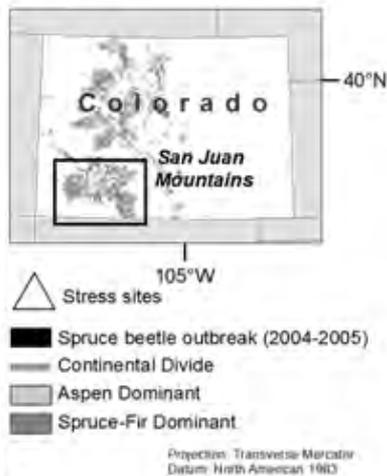
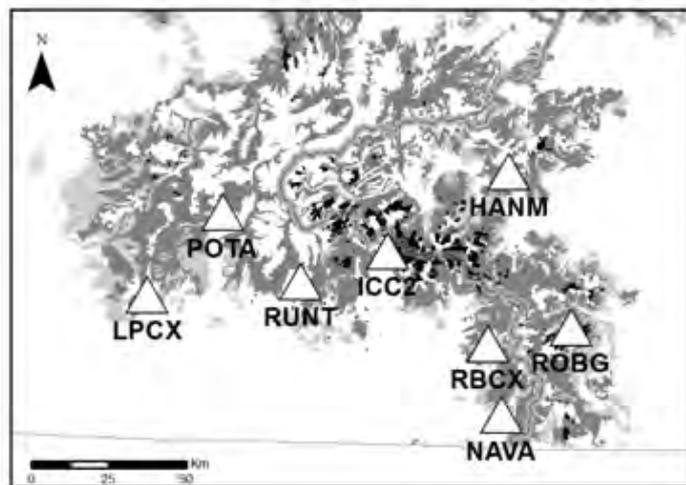
Why didn't severe outbreaks occur everywhere?



Why didn't severe outbreaks occur everywhere?



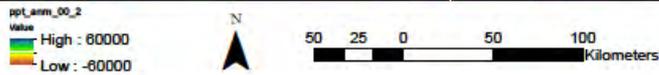
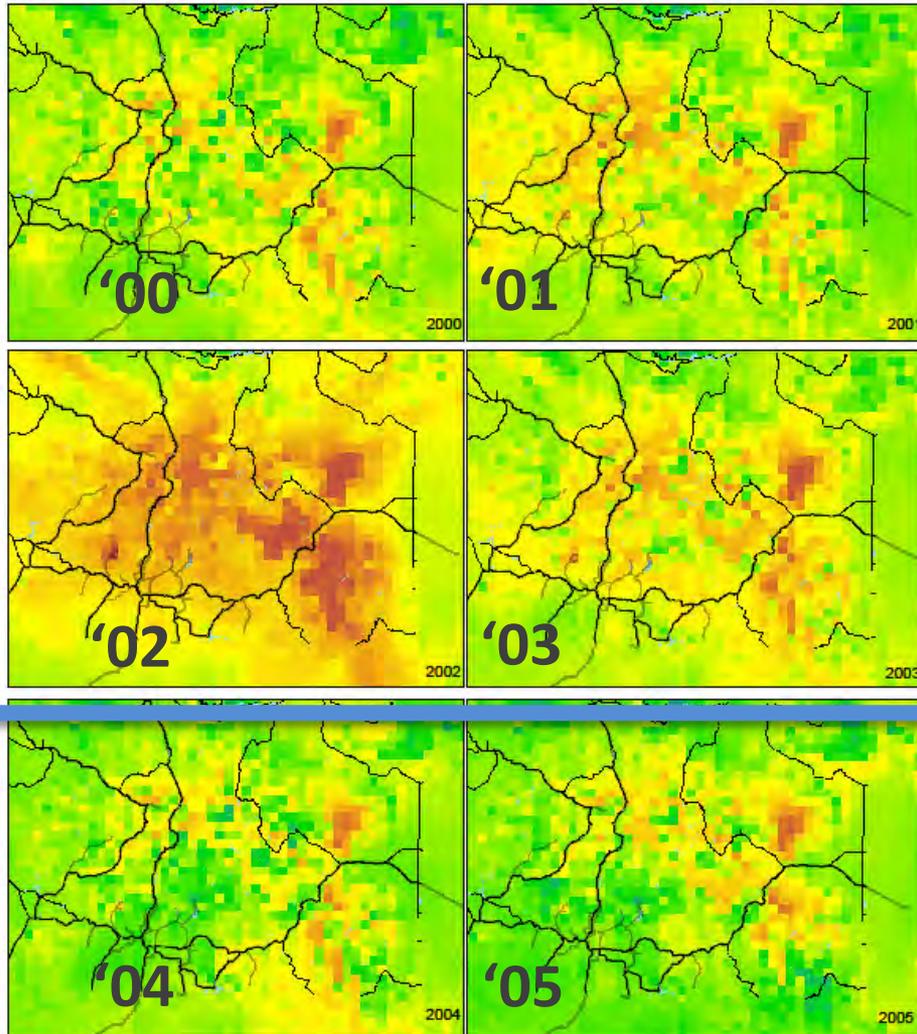
Why didn't severe outbreaks occur everywhere?



Precipitation departure from avg.

Yearly Precip Anomalies (1971-2000)

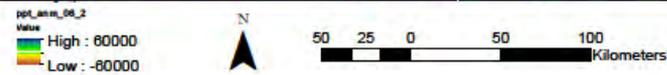
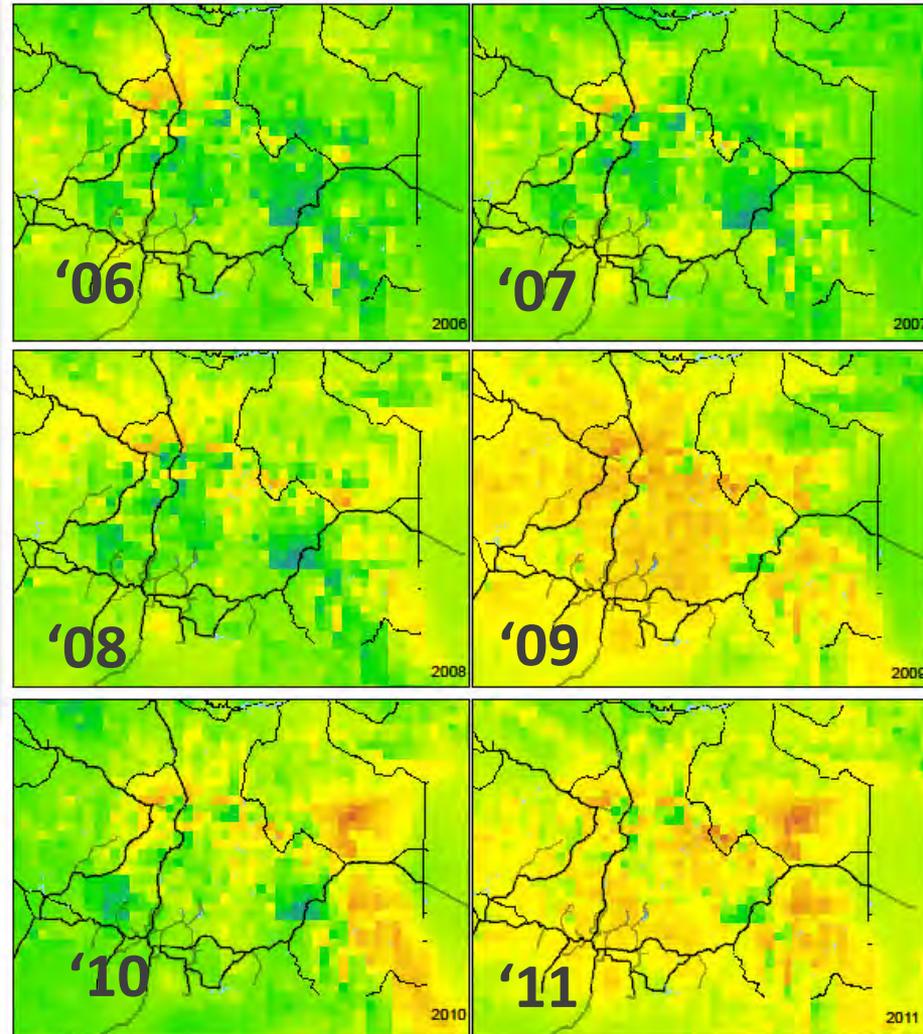
Data sources: PRISM (Parameter-elevation Regressions on Independent Slopes Model).



Coordinate System: NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

Yearly Precip Anomalies (1971-2000)
2006-2011

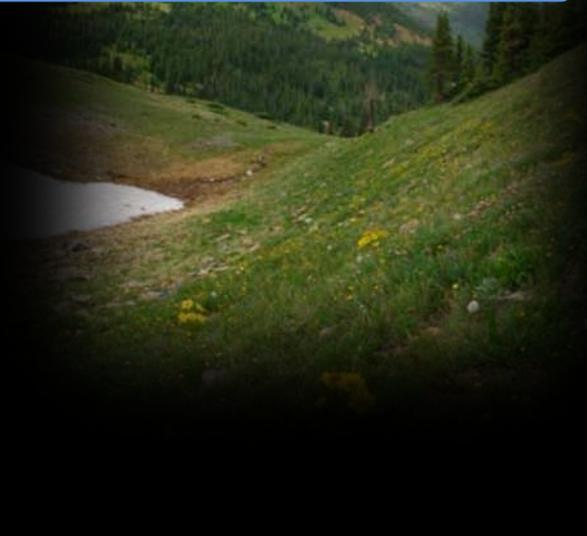
Data sources: PRISM (Parameter-elevation Regressions on Independent Slopes Model),
Prism Climate Group, Oregon State University.



Coordinate System: NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

Why didn't severe outbreaks occur everywhere?

Prior disturbances?



Why didn't severe outbreaks occur everywhere?

It's complicated



Reconstructing past outbreaks

- We cored dead trees

- We cored live trees

Dead w/ spruce
beetle galleries

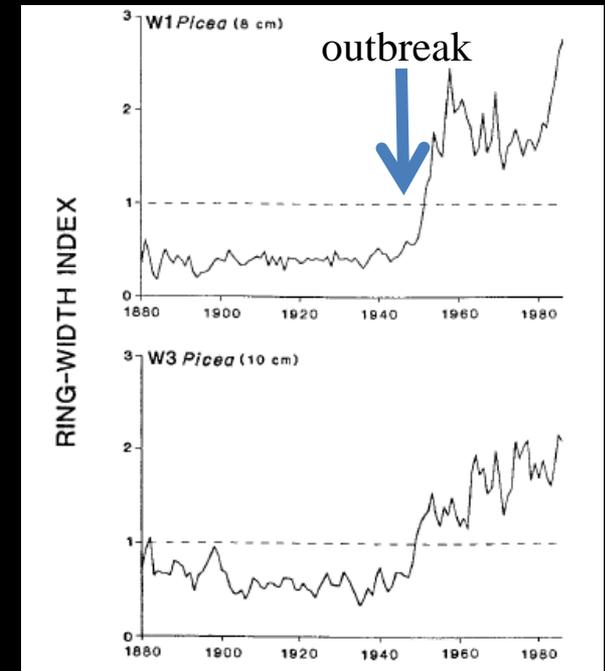
NOT killed during
current
outbreak

Still standing

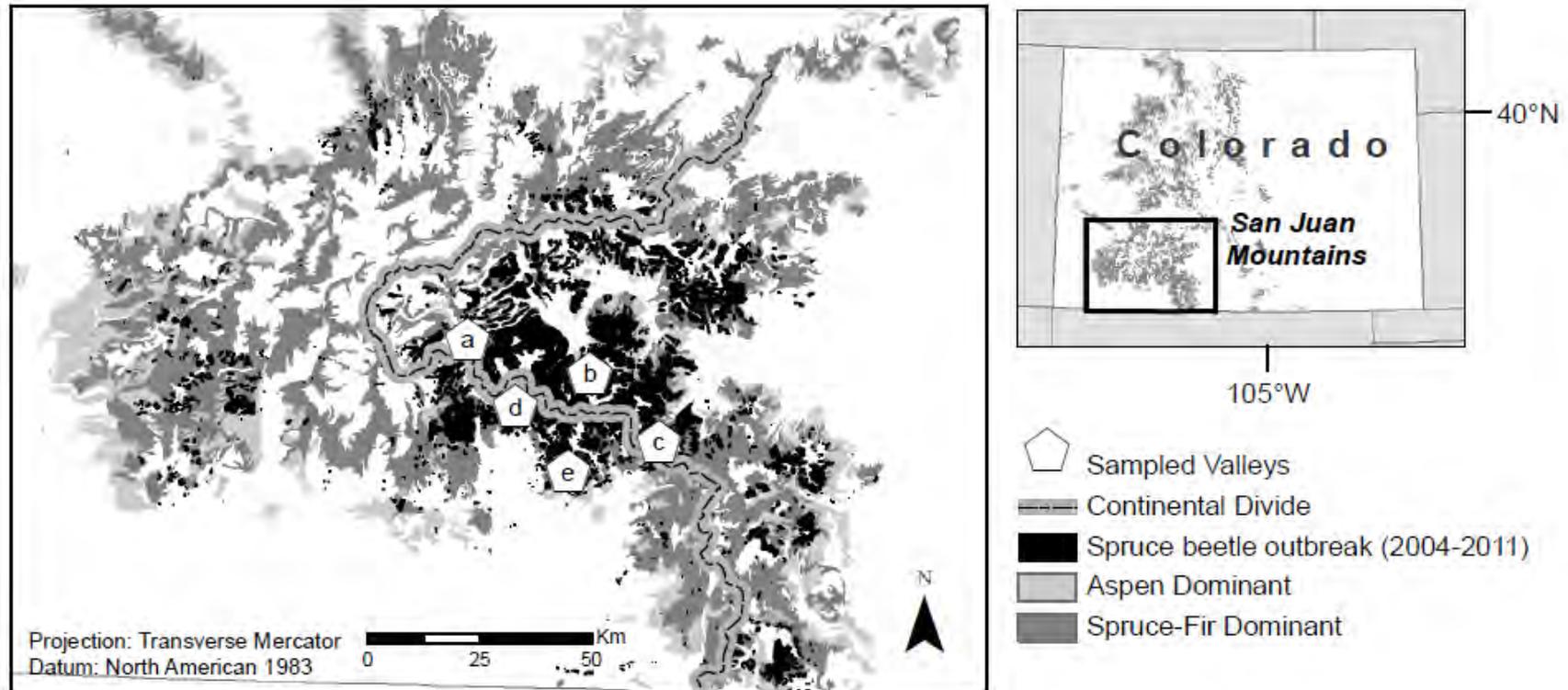
Outer ring assumed
to correspond
with year of
attack



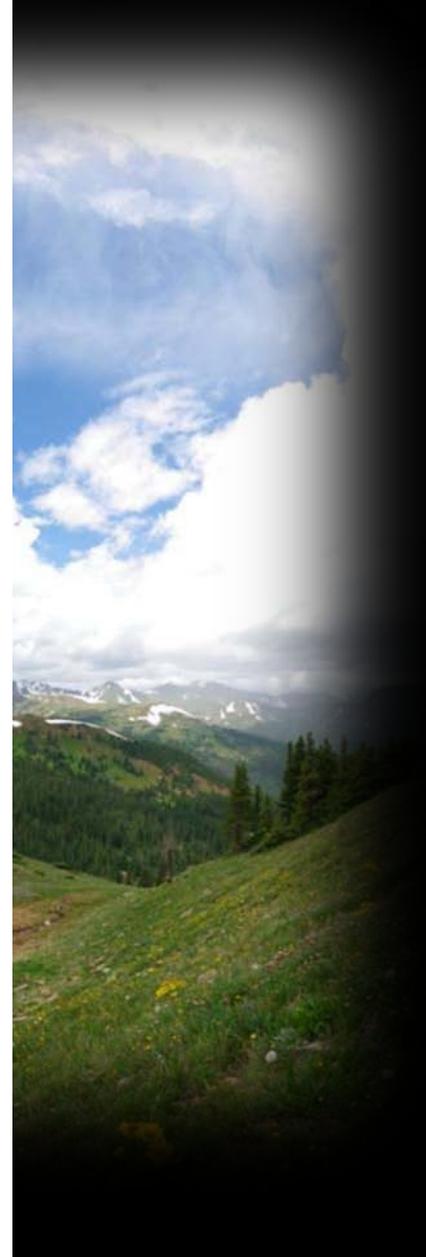
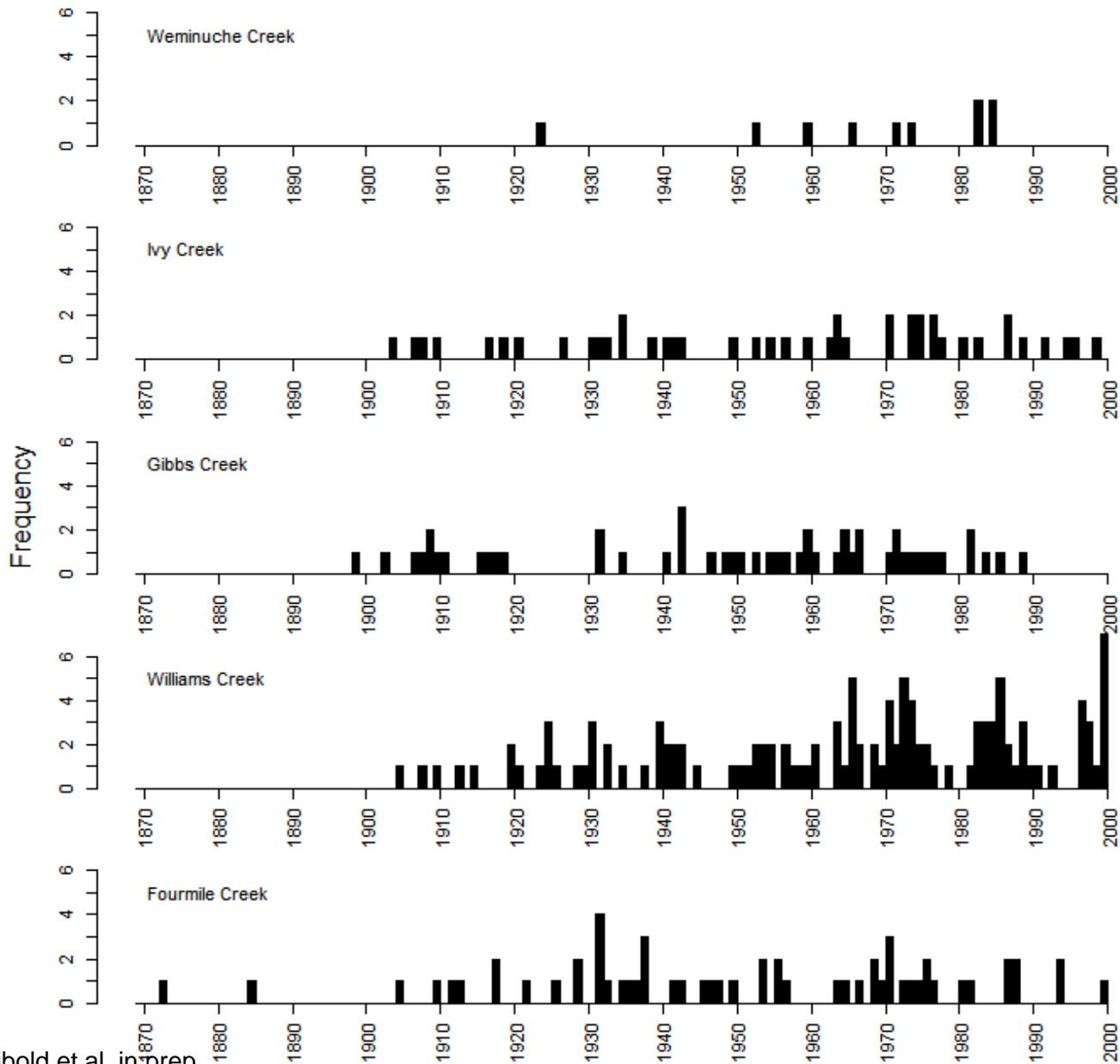
150% ↑ in growth



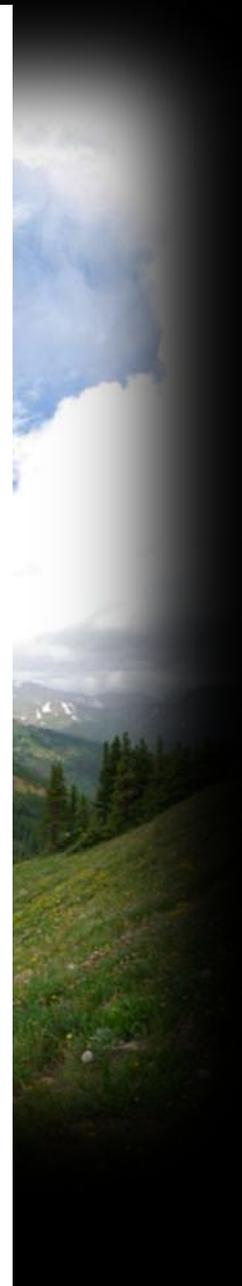
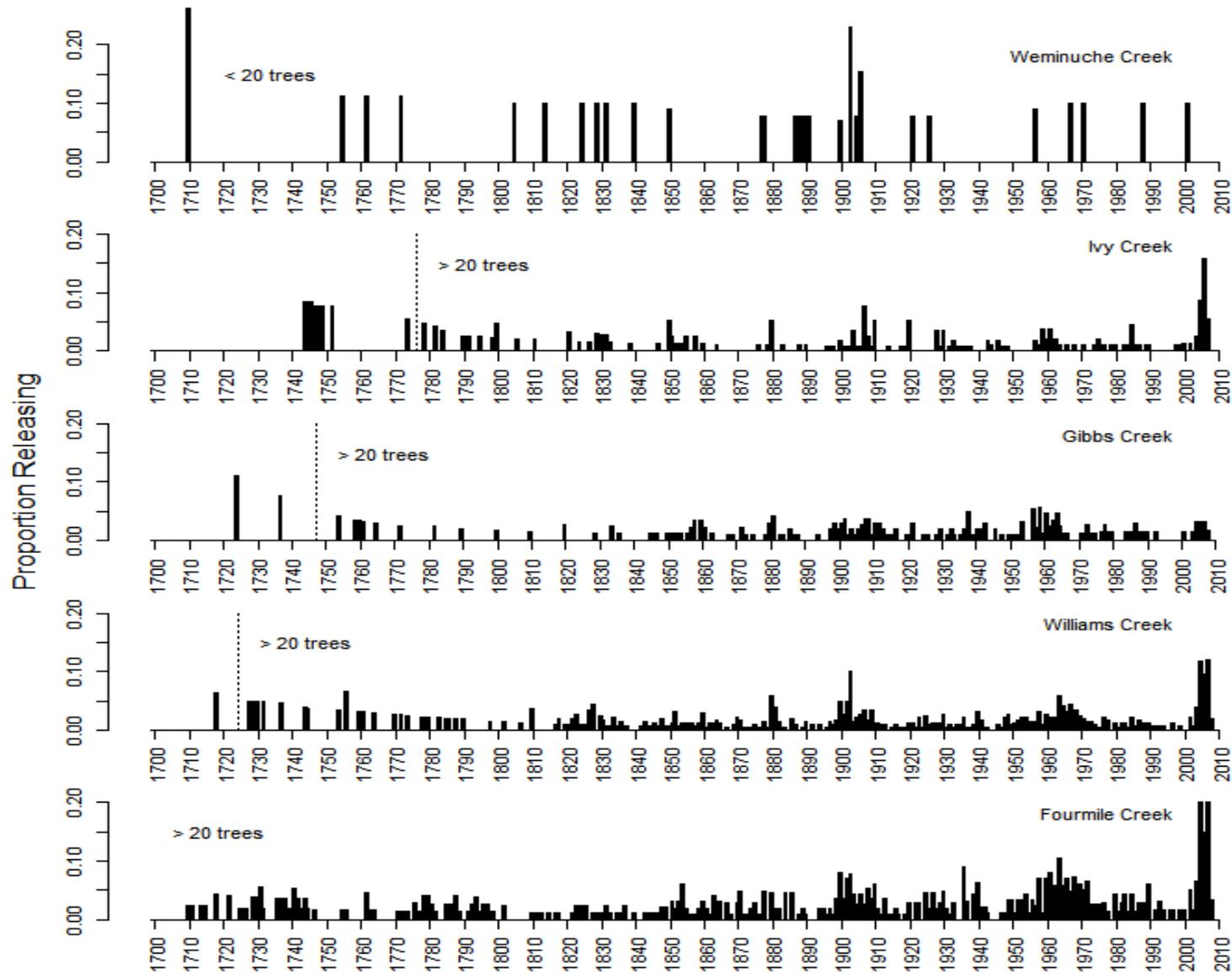
Reconstructing past outbreaks



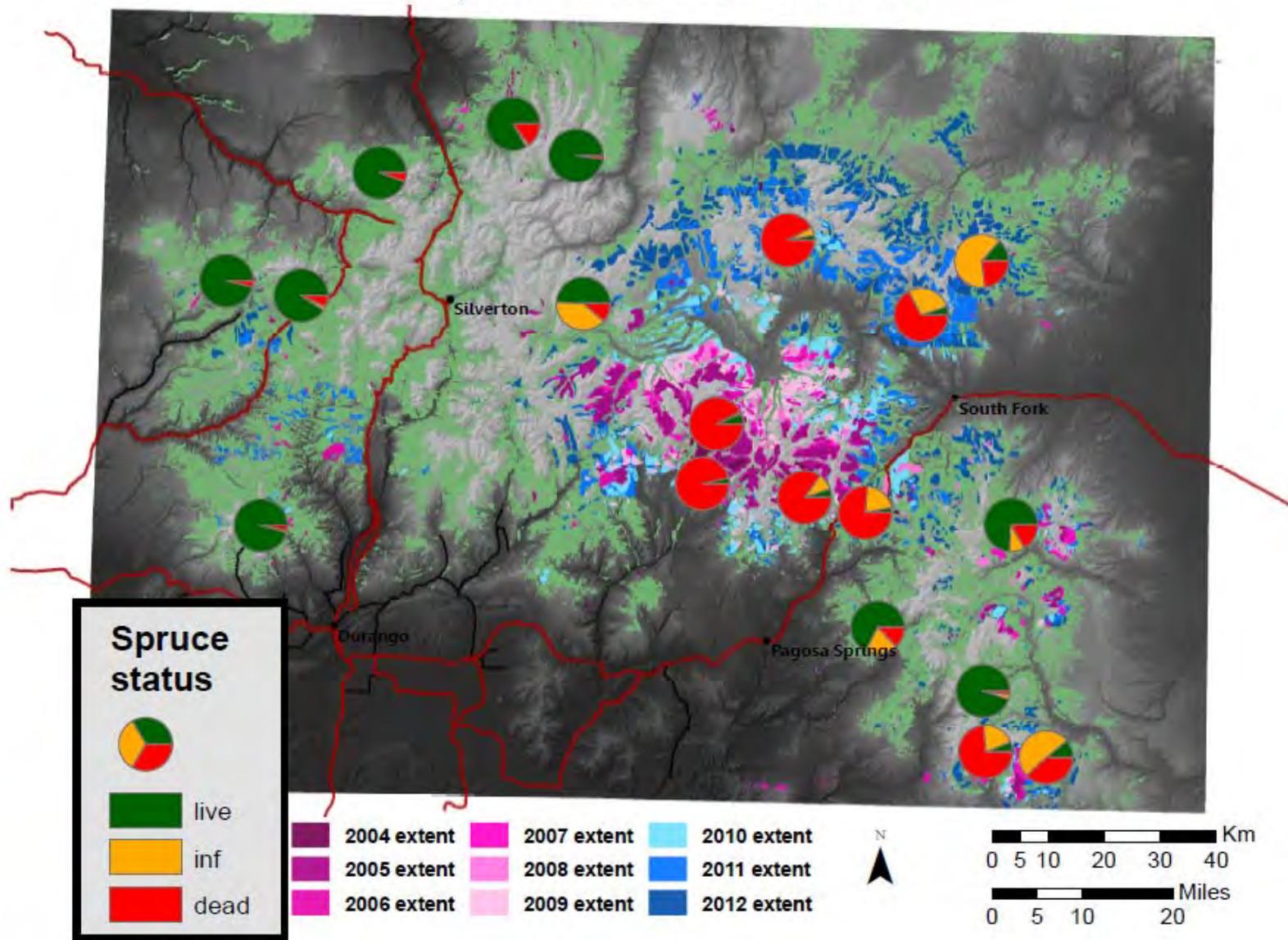
How have outbreaks occurred in the past?



How have outbreaks occurred in the past?



Spruce beetle in the San Juans



Acknowledgements

Jason Sibold (CSU)
Jose Negrón (USFS)
Rosalind Wu (USFS)
Tom Hobbs (CSU)
Dan Binkley (CSU)

Nell Kolden
Kelly Banta
Ty Beeton
Jake Betzen
Bailo



Spruce beetle in the San Juans (CO): spatial patterns and observations



David K. Scott

Biogeography Lab

Graduate Degree Program in Ecology

Colorado State University

davidks@rams.colostate.edu

