

Spatial patterns in the forest understory: relationships to overstory structure and plant life form



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background

overstory structure



life form/
reproductive mode

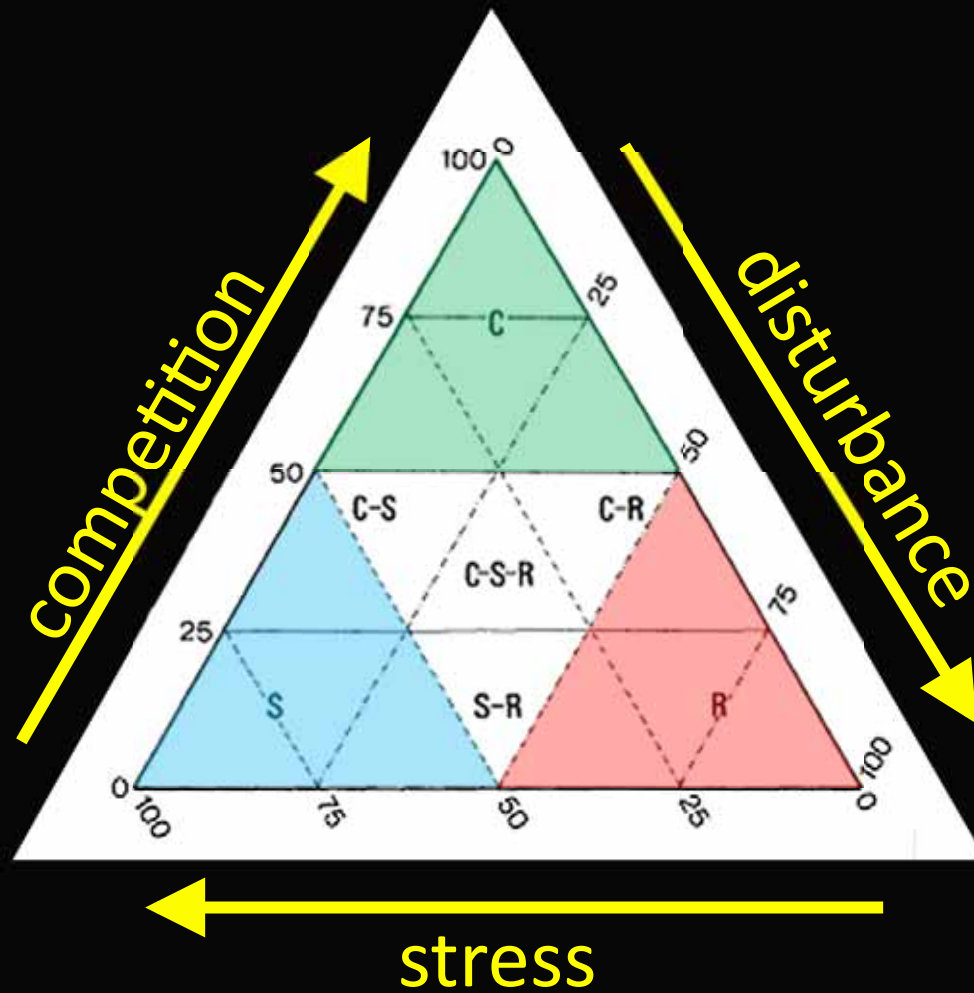
understory species

(abundance, richness, community composition)

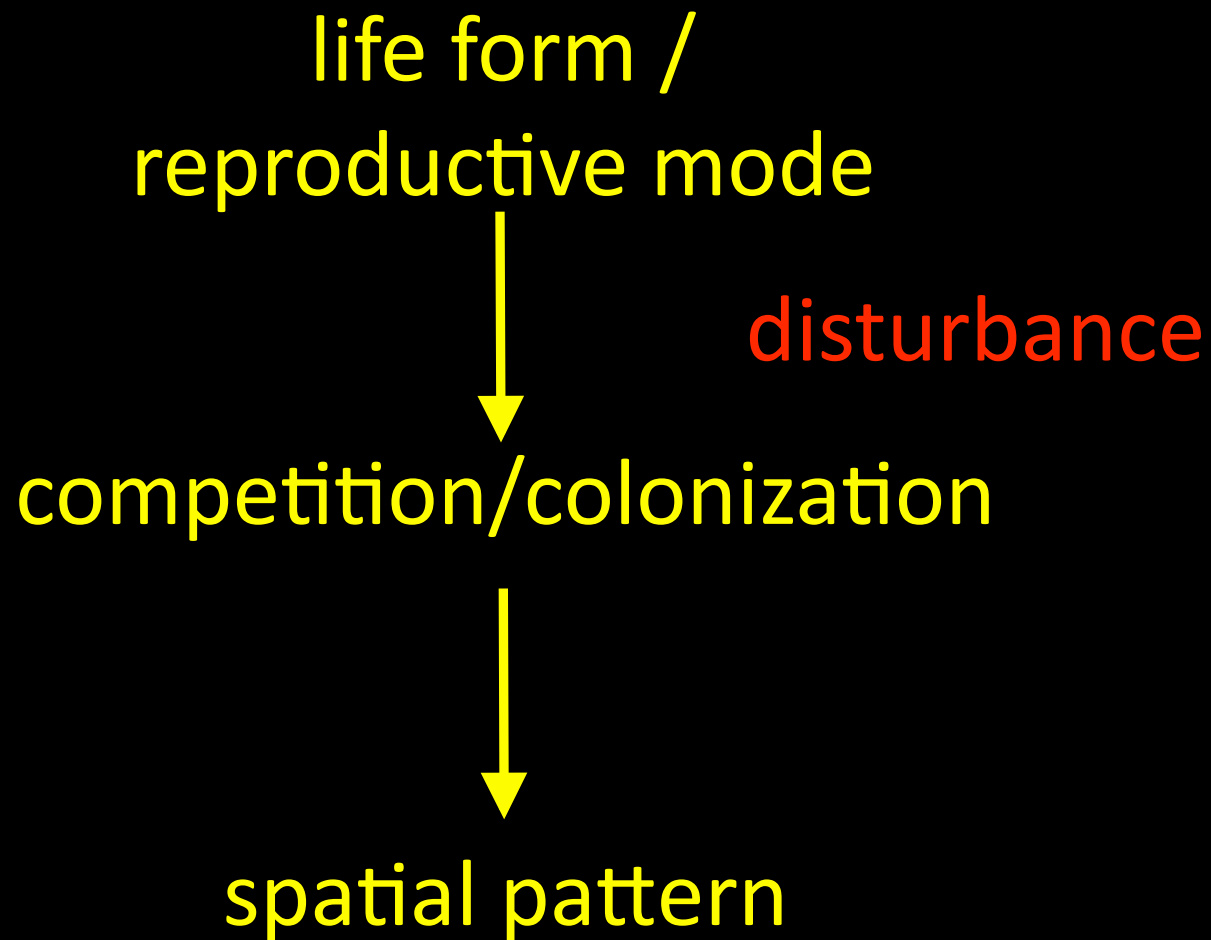
background

life form

C - S - R



background



background

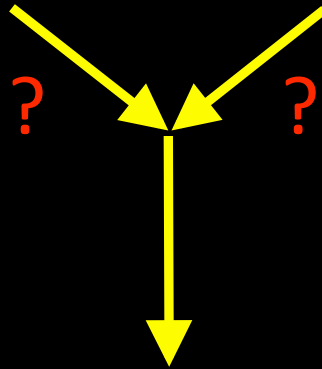
Plant spatial interactions

- overstory : neighborhood
- sedges, annuals
- overstory → understory?

background

overstory
structure

life form /
reproductive mode



spatial pattern of
understory species (patch size)

background



• clonal shrubs

- *Gaultheria shallon* (salal)
- *Mahonia nervosa* (Oregon-grape)
- *Rubus spectabilis* (salmonberry)
- *Rubus ursinus* (trailing blackberry)
- *Rubus armeniacus* (Himalayan blackberry)

• annuals

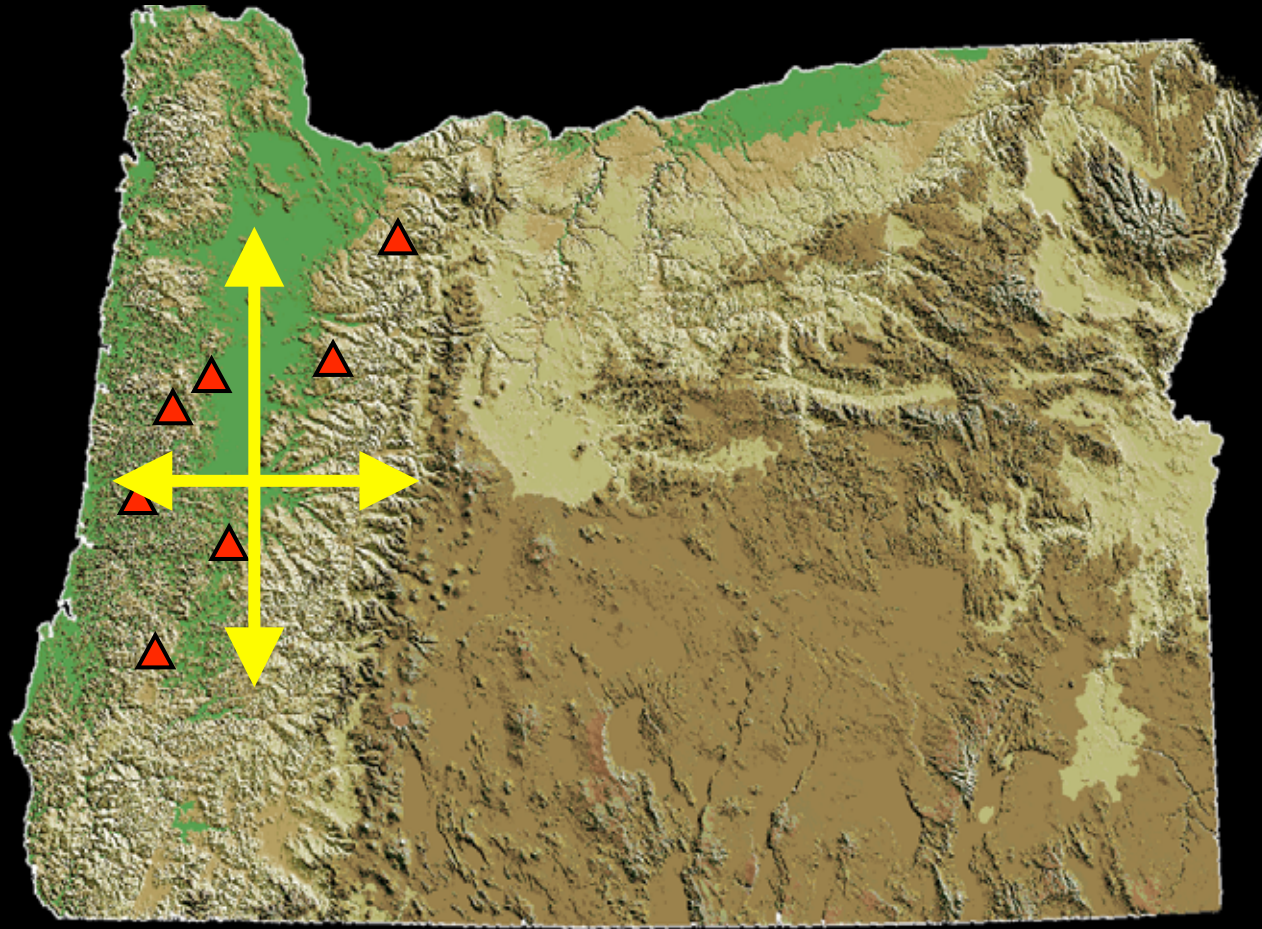
- *Senecio sylvaticus* (woodland ragwort)
- *Galium aparine* (stickywilly)

Research question



Do the patch sizes of clonal shrubs and annual ruderals respond differently to gradients in overstory density and spatial heterogeneity?

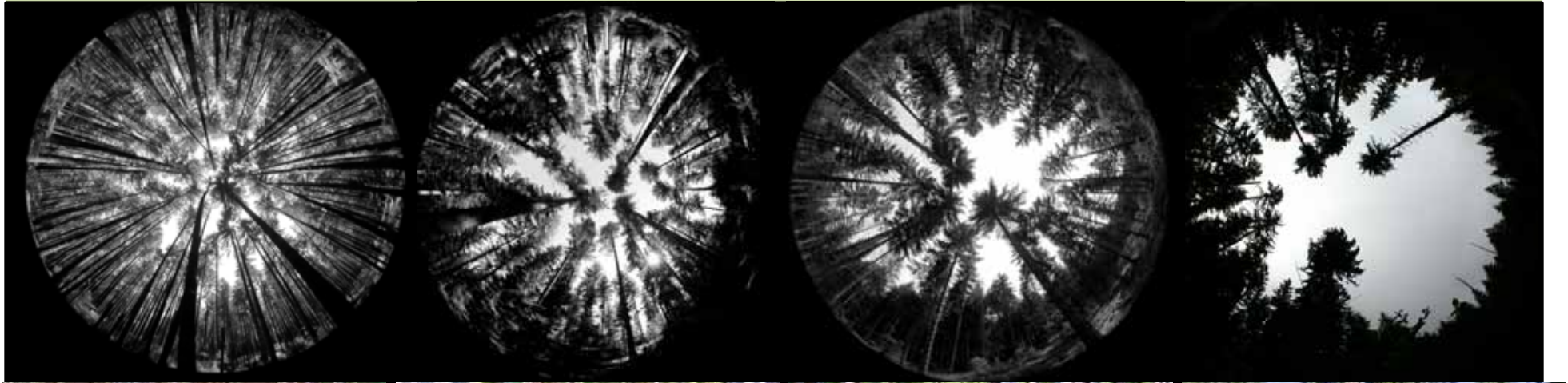
study sites



BLM Density Management Study



study sites: overstory gradients



control

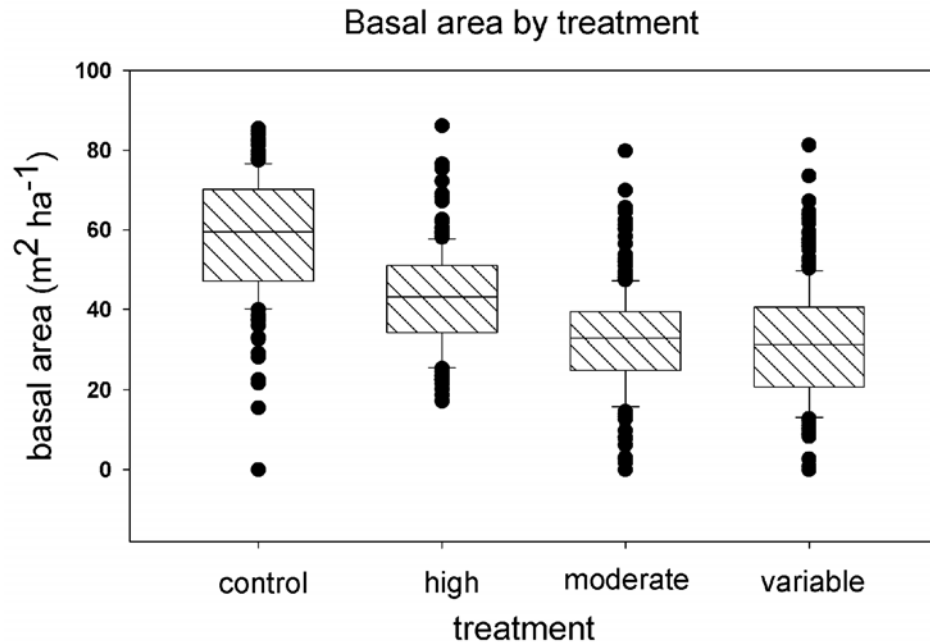
high density moderate density

variable density



density density
spatial heterogeneity

study sites: overstory gradients



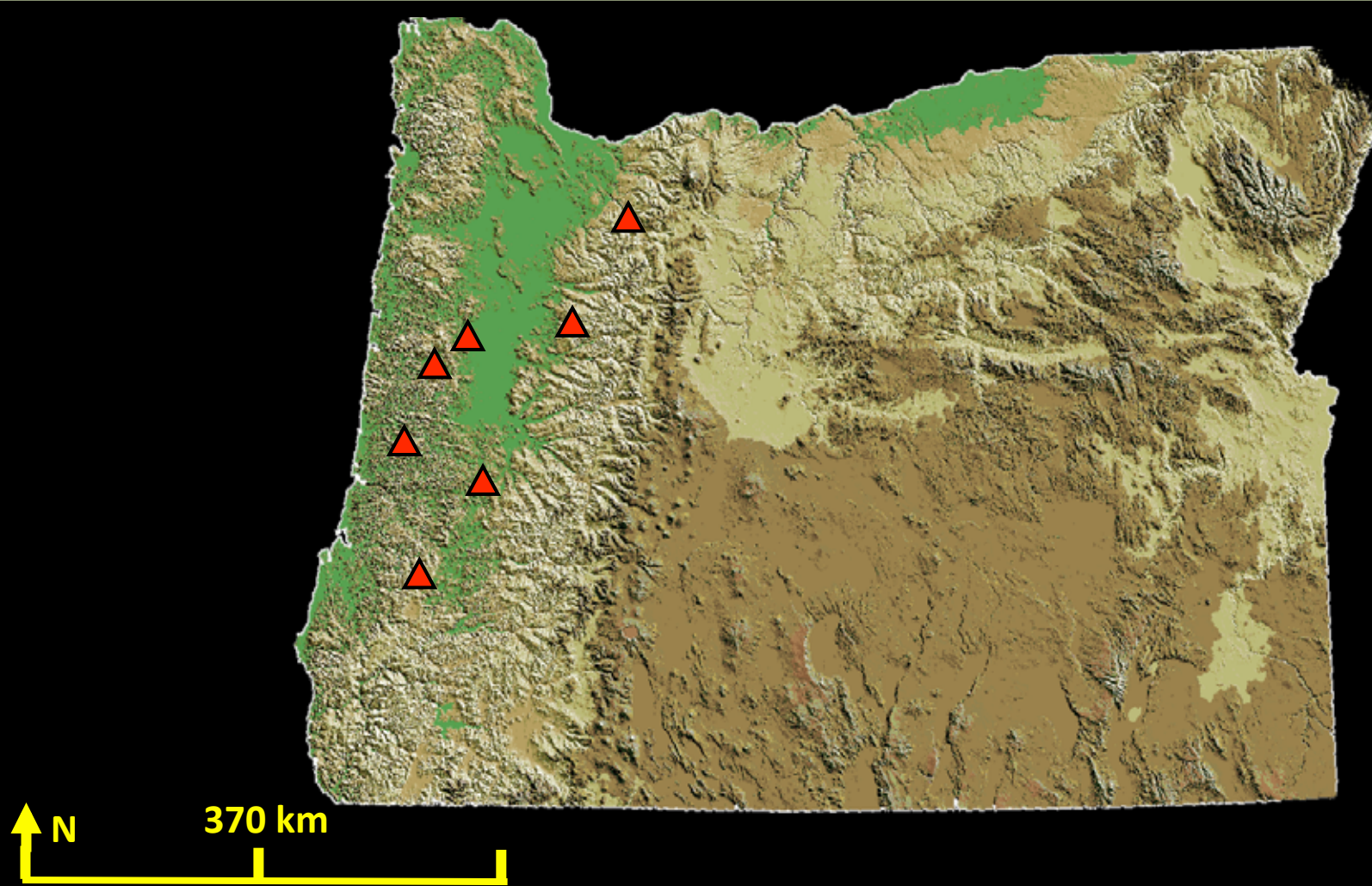
density



spatial heterogeneity



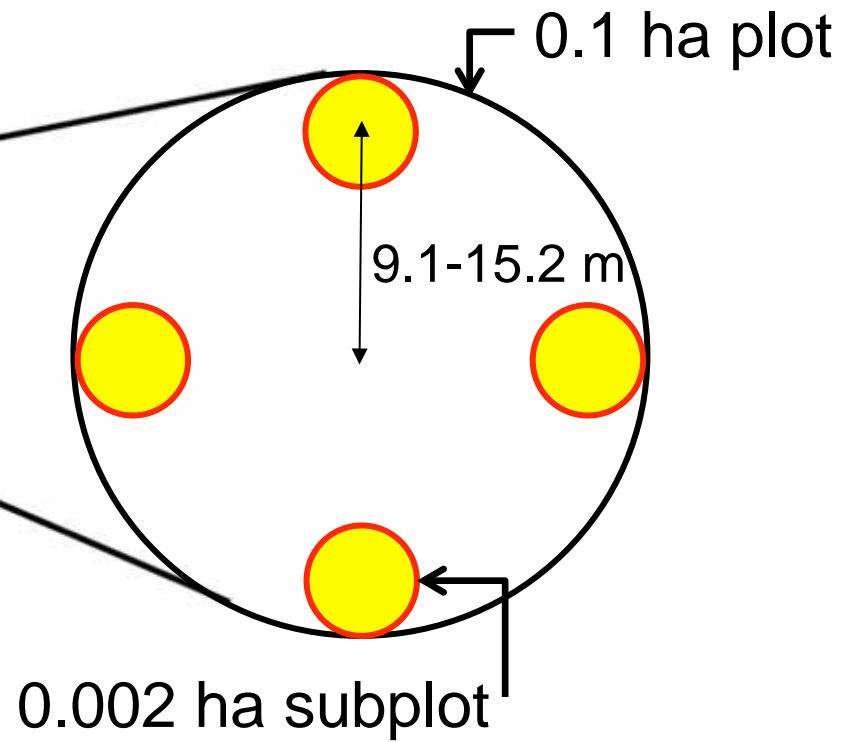
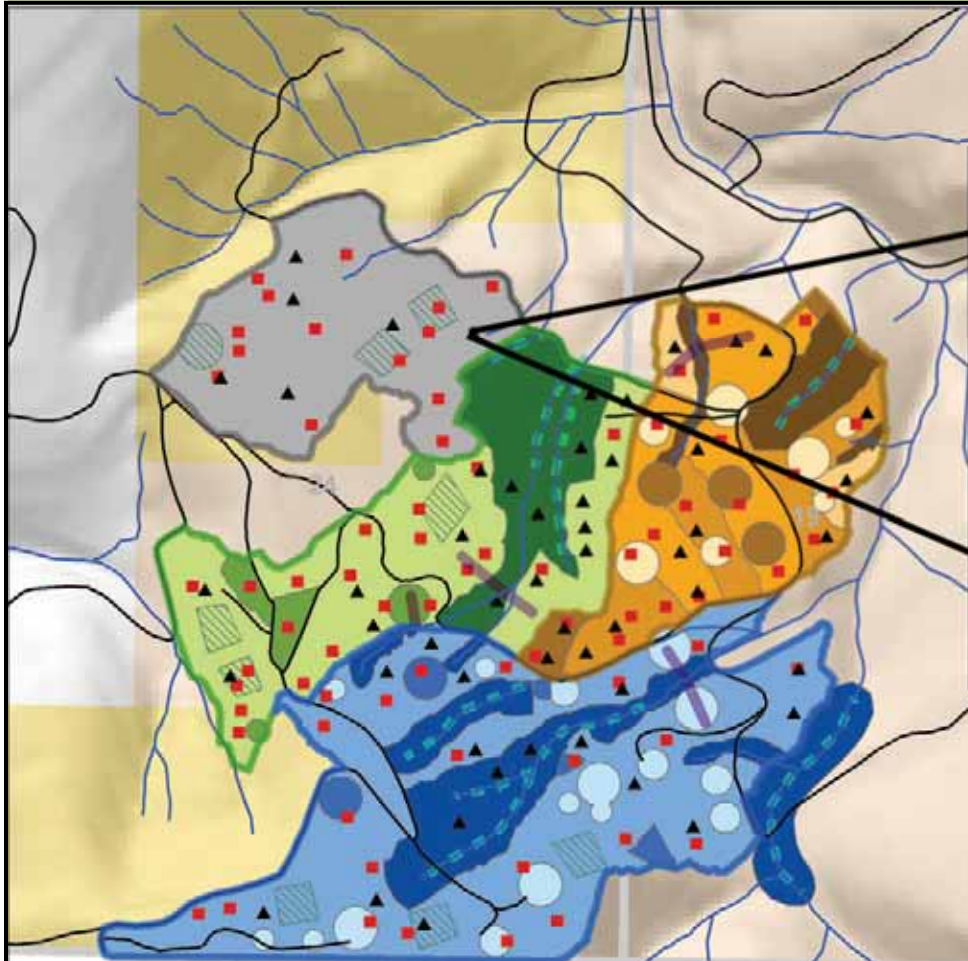
study sites



BLM Density Management Study



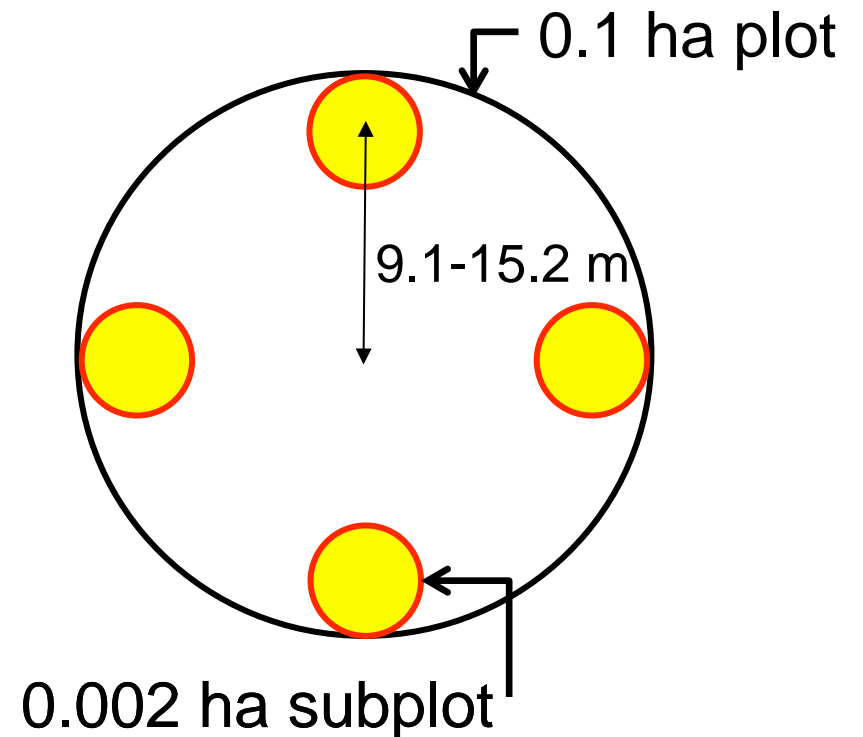
study sites: sampling



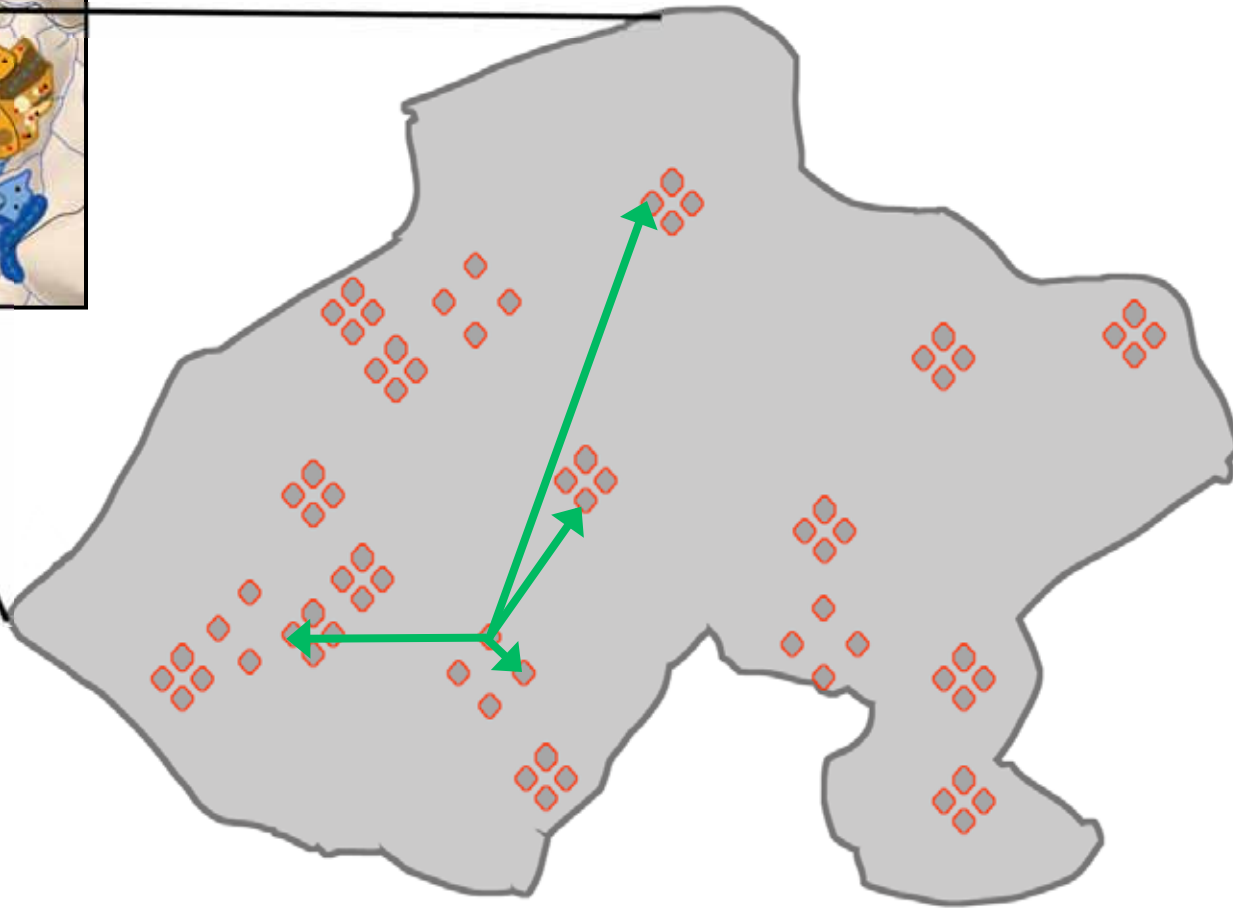
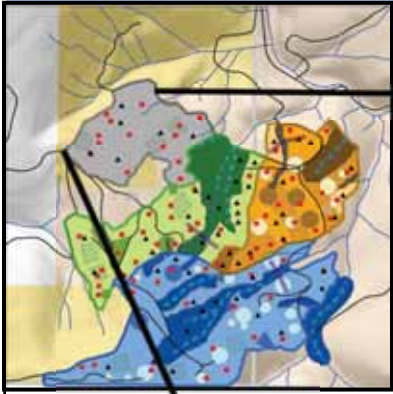
study sites: sampling

subplot measurements:

- percent cover:
 - 5 clonal shrub species
 - 2 annual species
- Subplot UTM

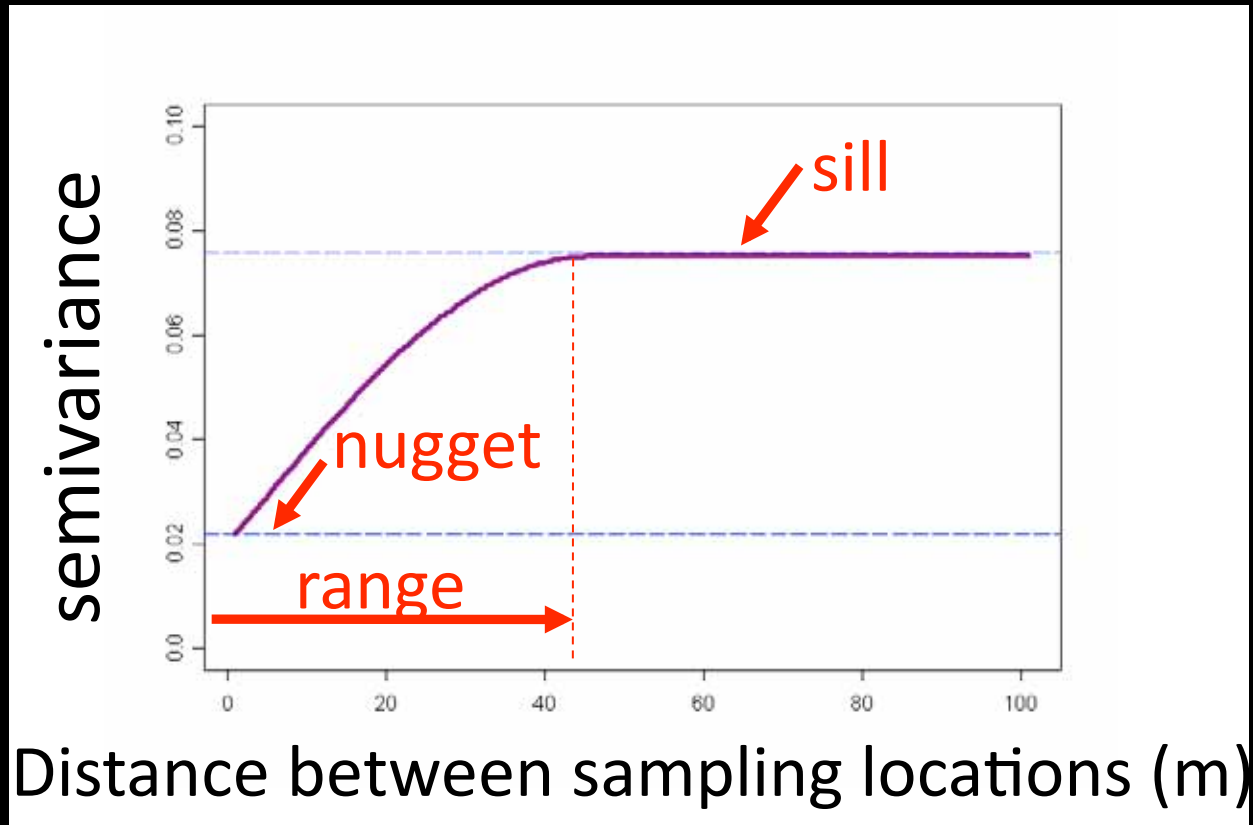


geostatistical analysis

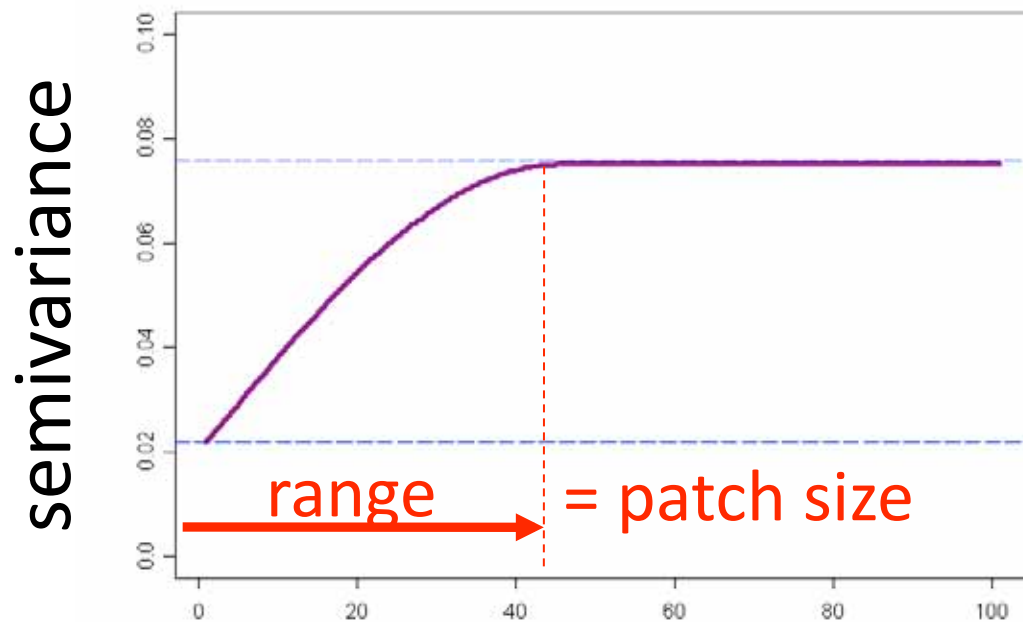


Sampling locations

geostatistical analysis

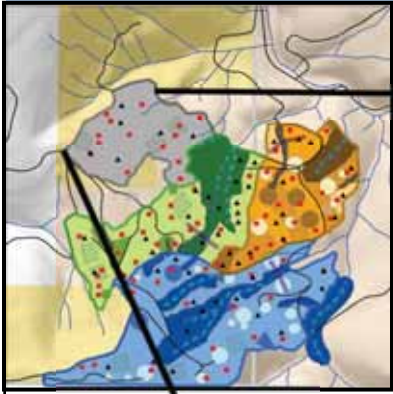


geostatistical analysis



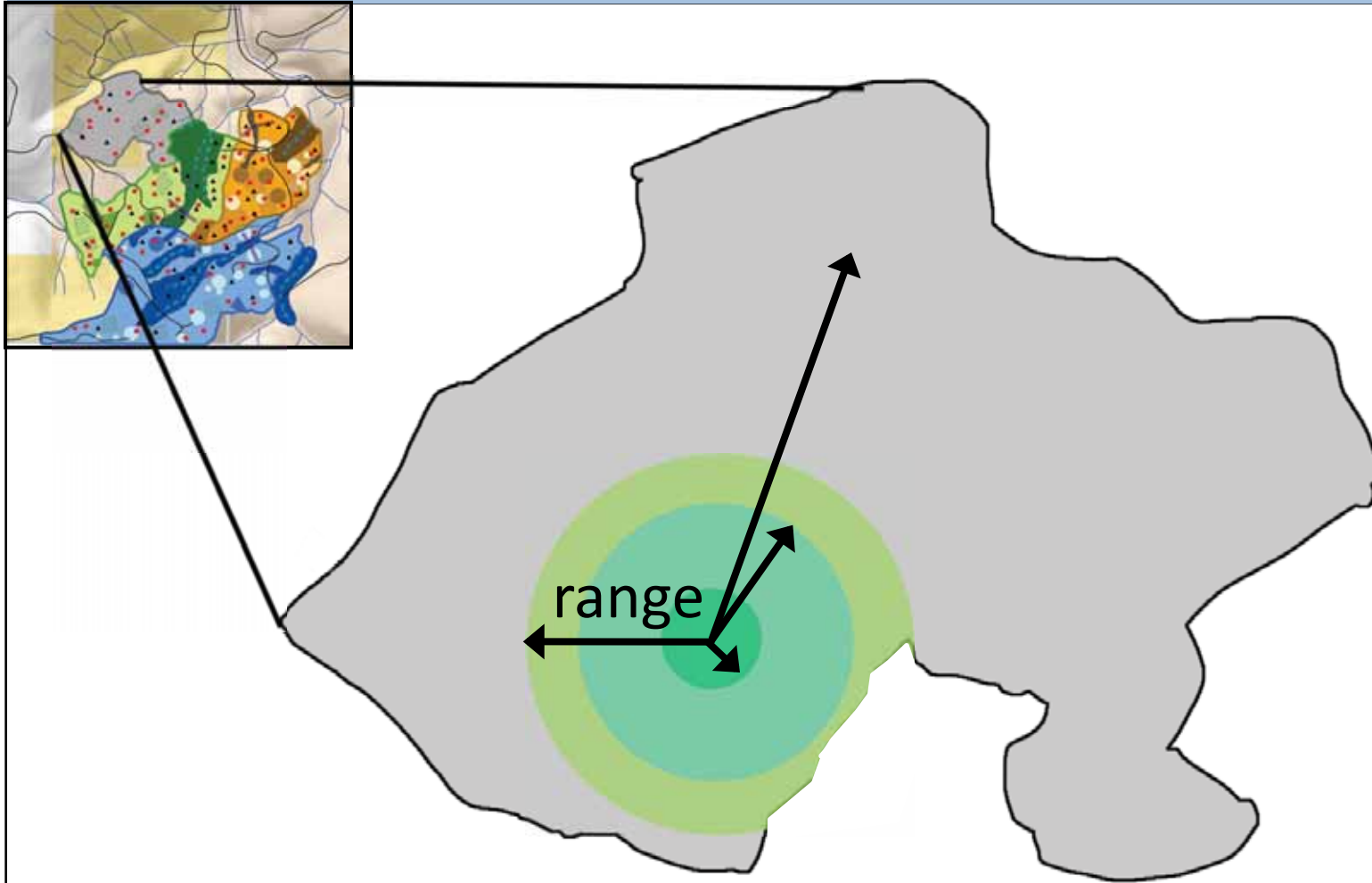
Distance between sampling locations (m)

geostatistical analysis

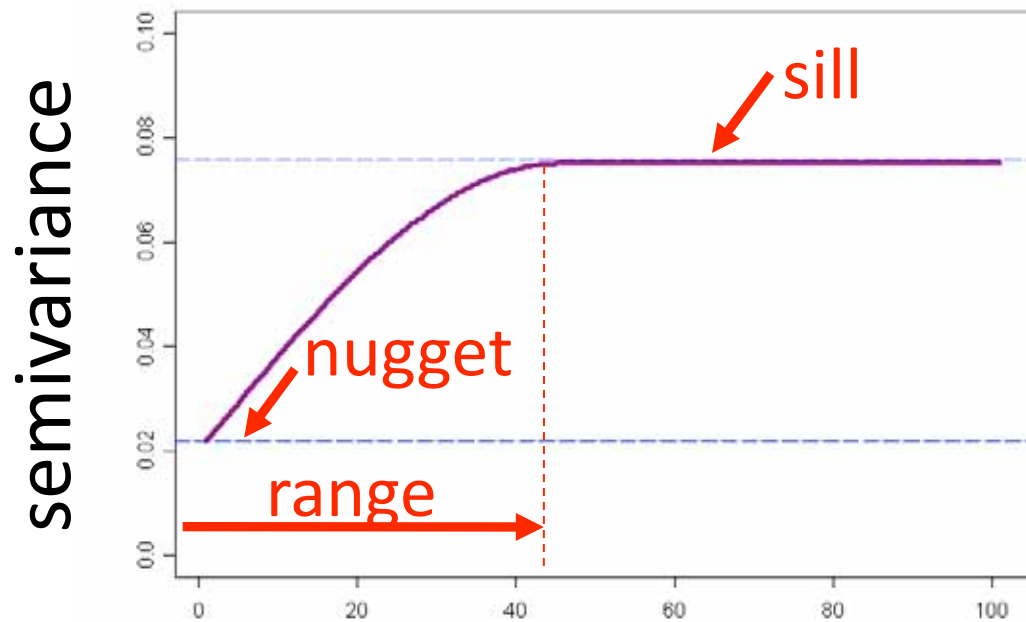


Sampling locations

geostatistical analysis

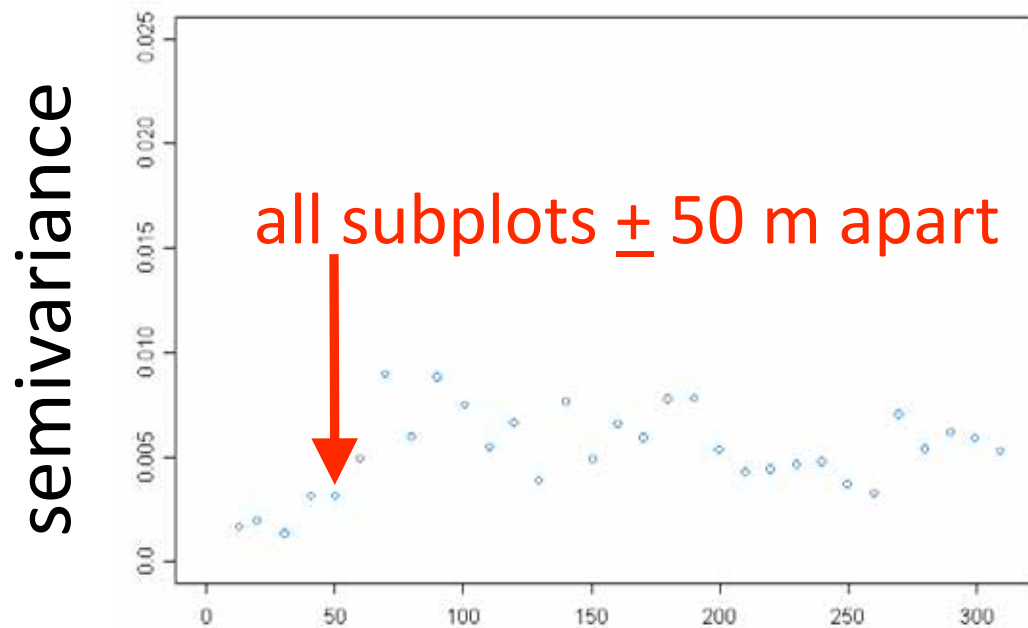


geostatistical analysis



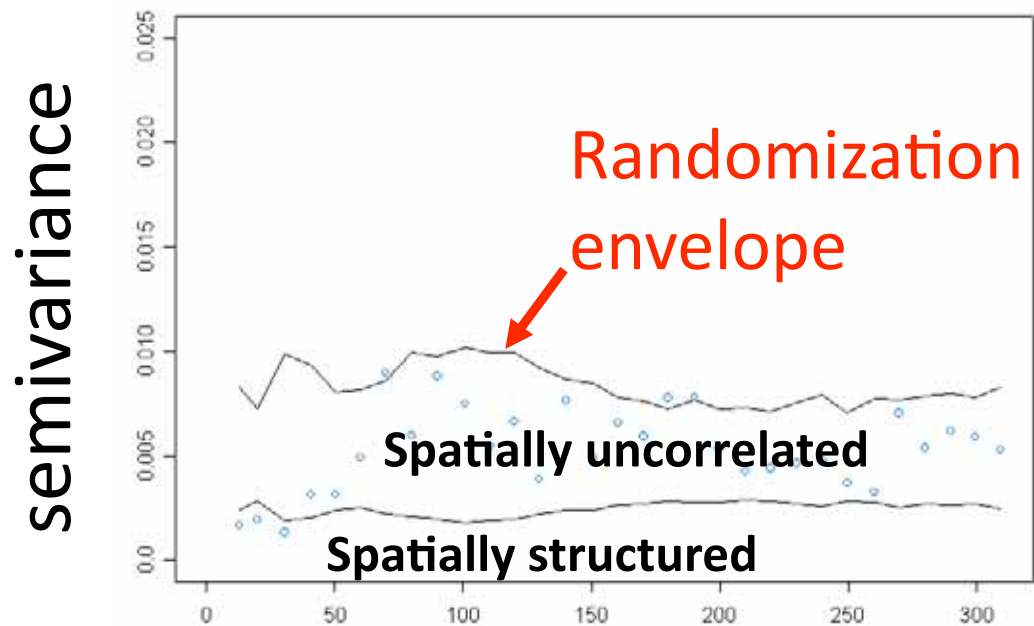
Distance between sampling locations (m)

geostatistical analysis



Distance between sampling locations (m)

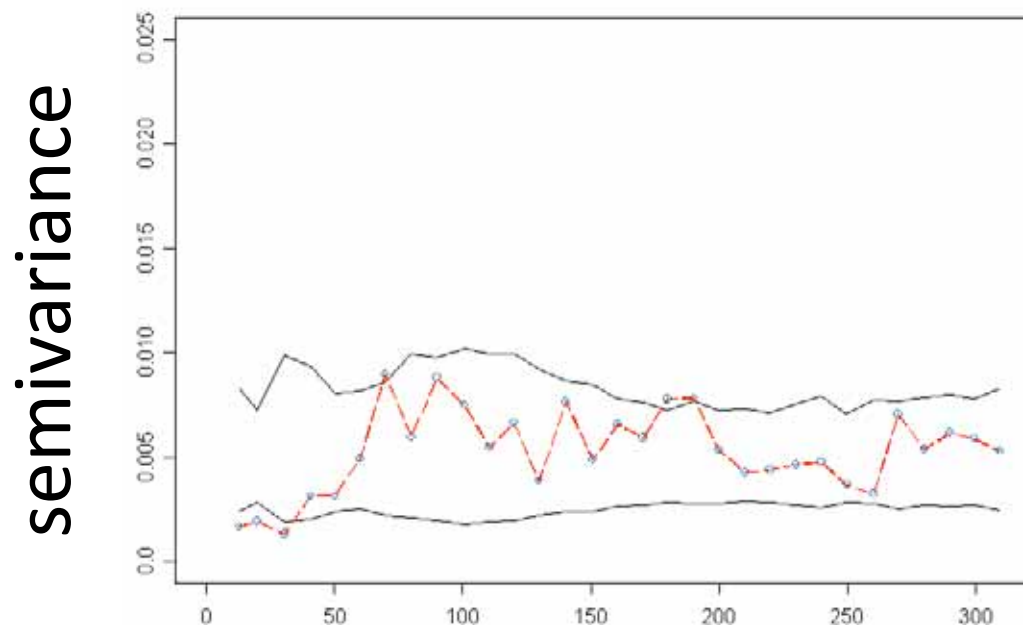
geostatistical analysis



Distance between sampling locations (m)

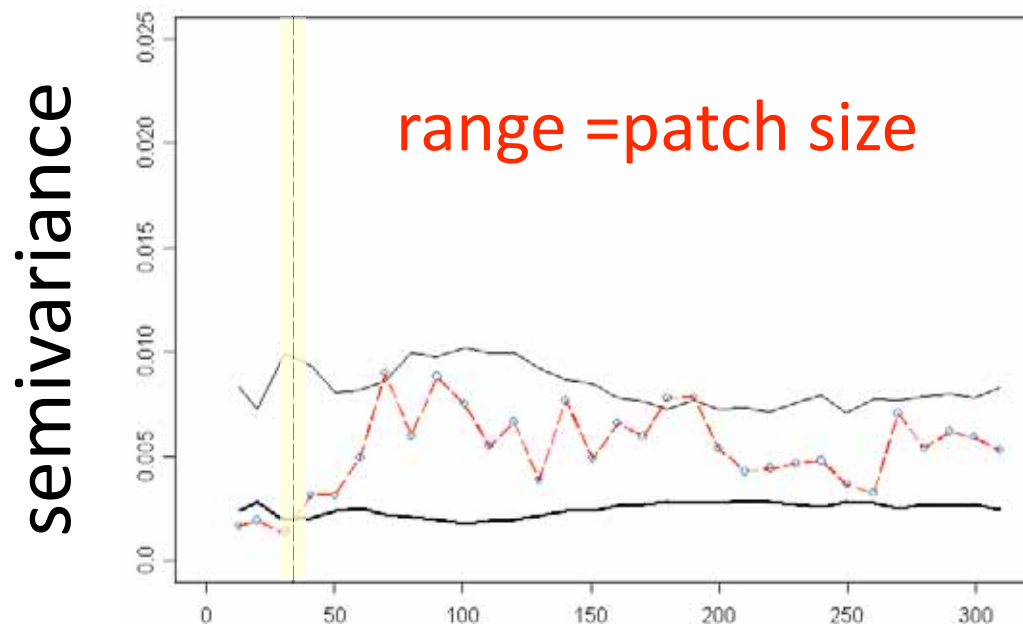
Ganio et al. 2005

geostatistical analysis



Distance between sampling locations (m)

geostatistical analysis



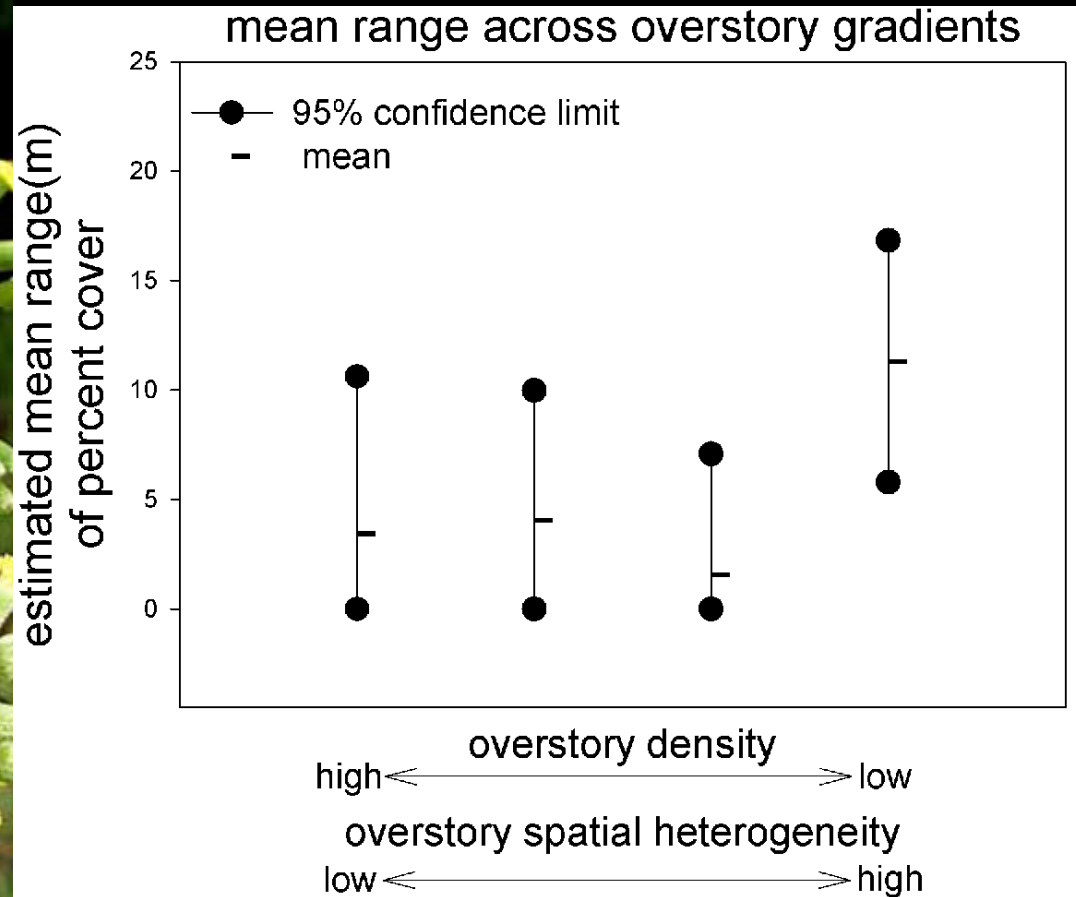
Distance between sampling locations (m)

data analysis

- Mean range of clonal shrubs and annual ruderals within each treatment at each site
- Mixed model:
 - Fixed: TRT, group, TRT*group
 - Random: sites, treatment areas & groups within sites

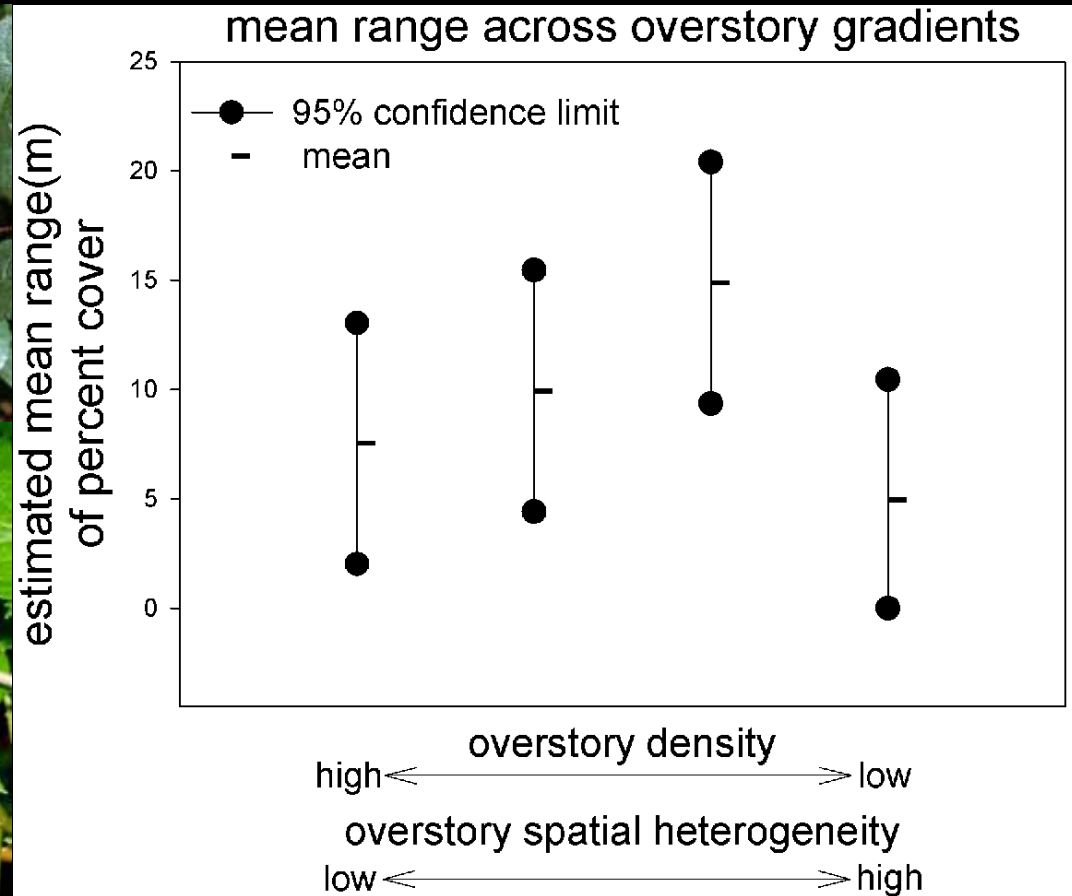
results

annual ruderals



results

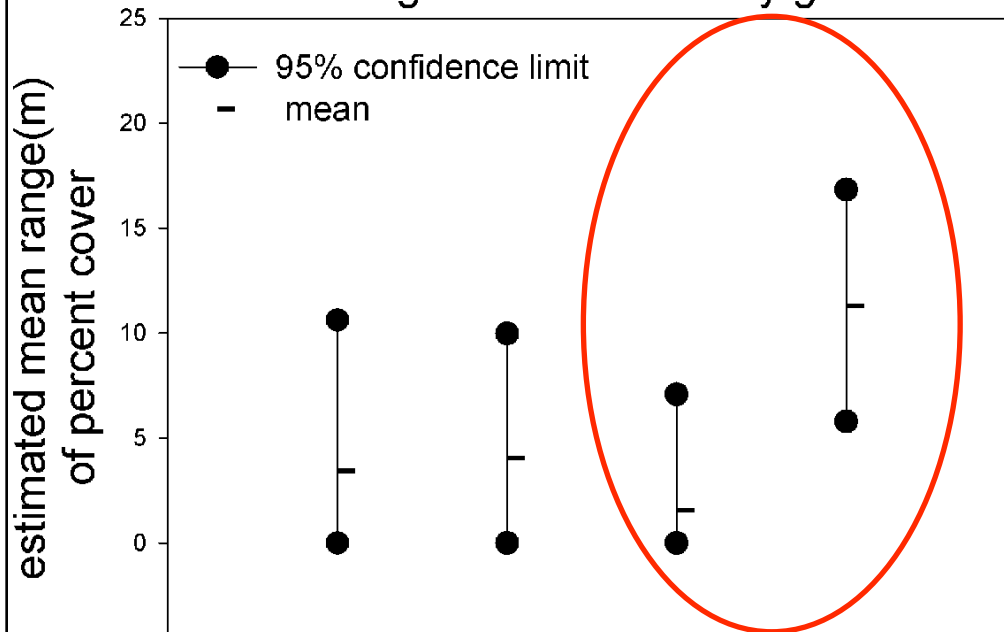
clonal shrubs



results

annual ruderals

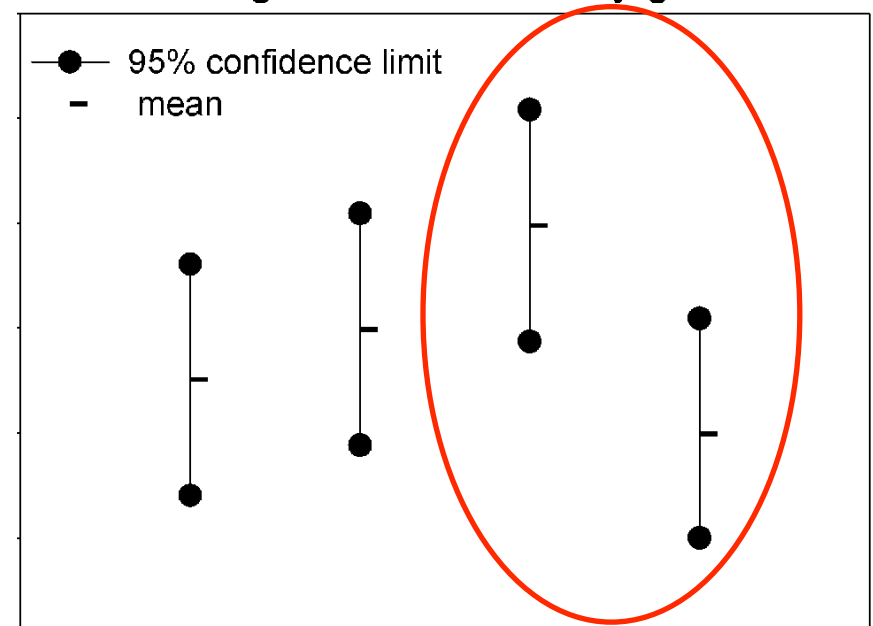
mean range across overstory gradients



high ← overstory density → low
overstory spatial heterogeneity
low ← → high

clonal shrubs

mean range across overstory gradients



high ← overstory density → low
overstory spatial heterogeneity
low ← → high

discussion

annual ruderals

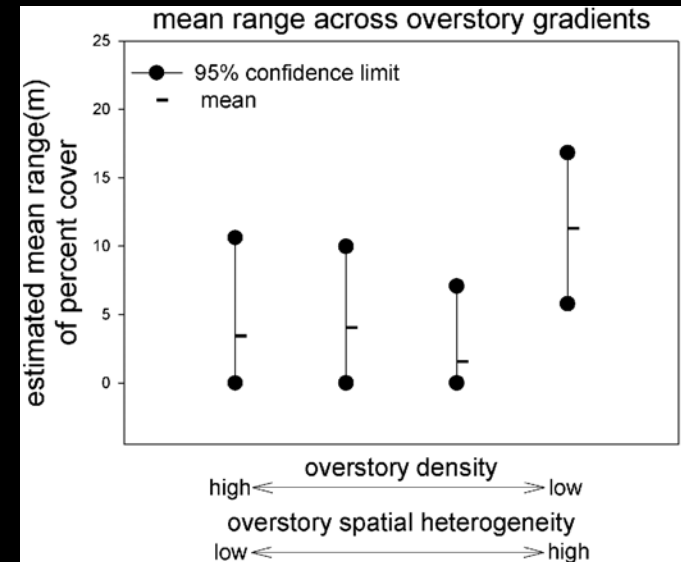
- zero at most levels of gradients

seed dispersal; no pattern

scarcity

- response to min density/max. heterogeneity

spatial 'dependence' on disturbance



discussion

clonal shrubs

- steady response to overstory gradients

adaptation to patchy resources

- decrease at min. density/max.

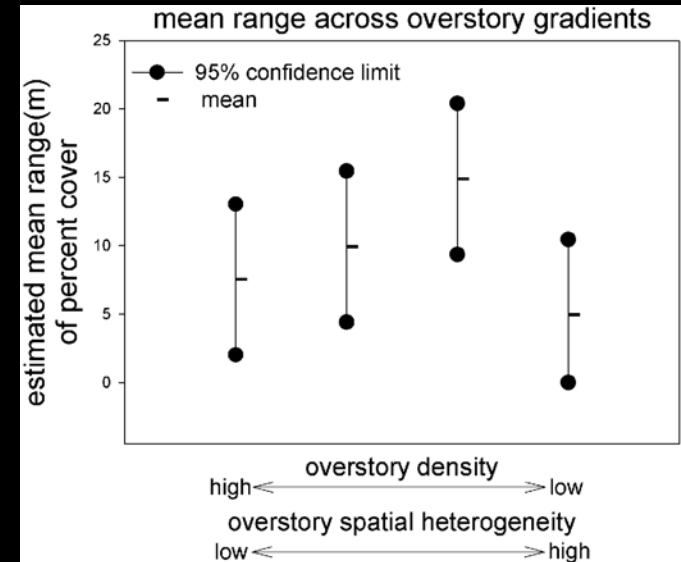
heterogeneity:

(physical extent or spatial structure?)

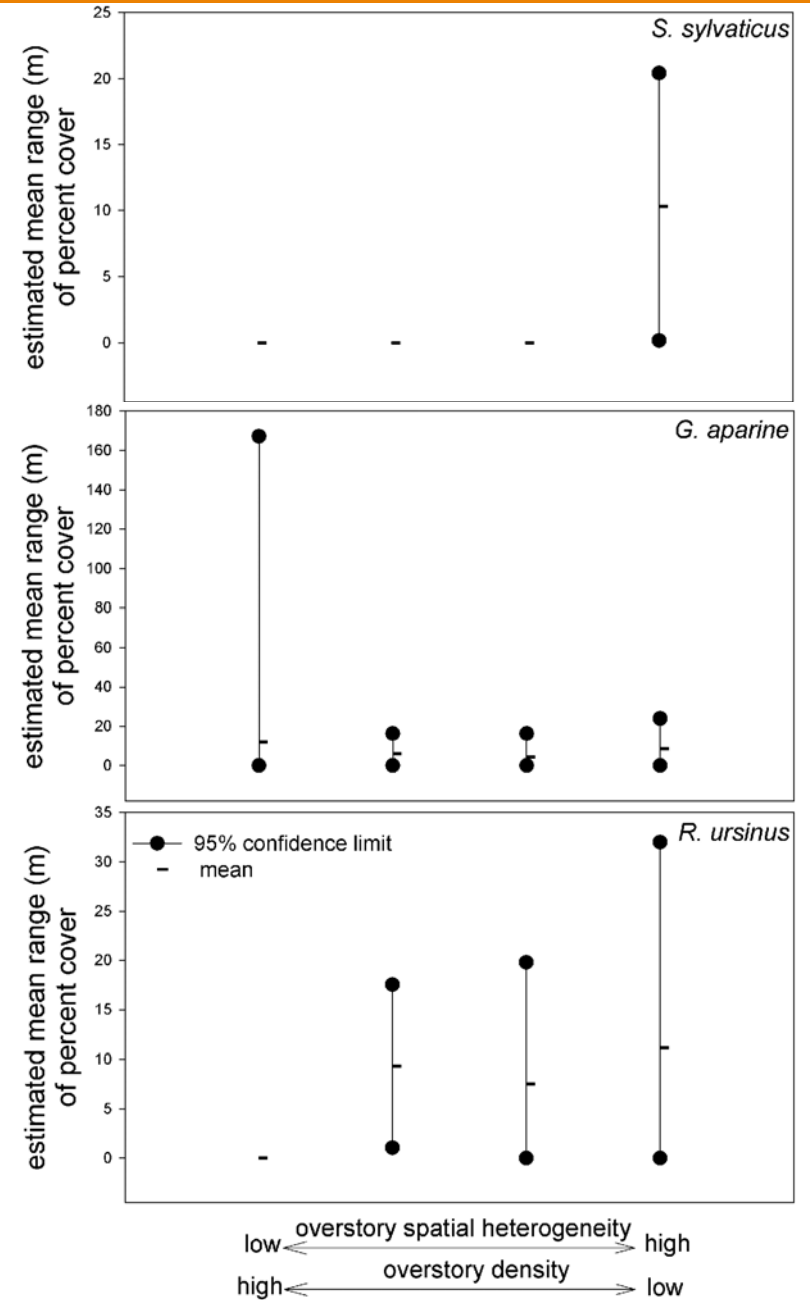
inhibition in full sunlight

thinning damage

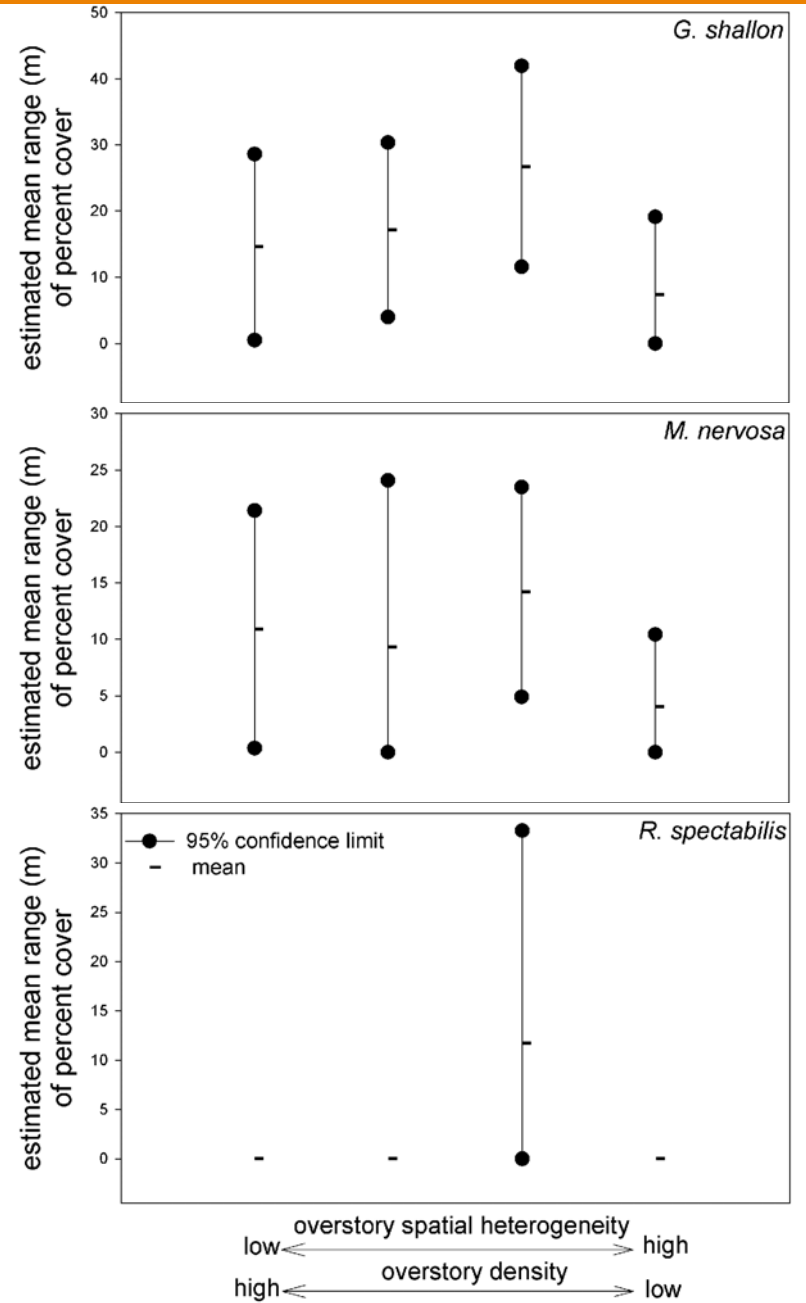
fruiting



results



results



results

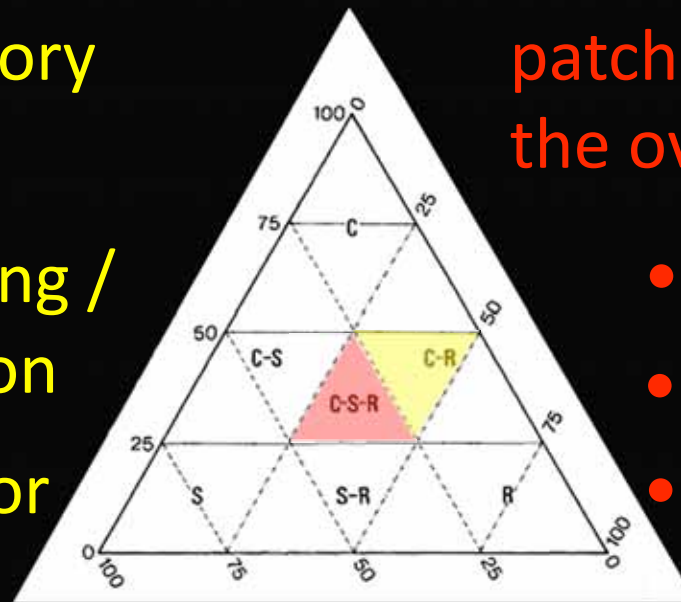


R. ursinus: ruderal-like response to overstory gradients

- moderate fruiting / lateral expansion
- weak competitor

R. armeniacus: showed no patch size at any level of the overstory gradients

- more fruiting/clonal
- wide tolerances
- strong competitor

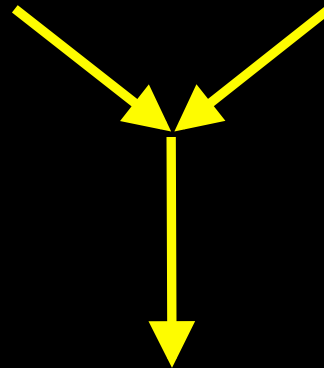


C-S-R → no spatial pattern

future directions

overstory
structure

life form /
reproductive mode



spatial pattern of
understory species

(patch size)

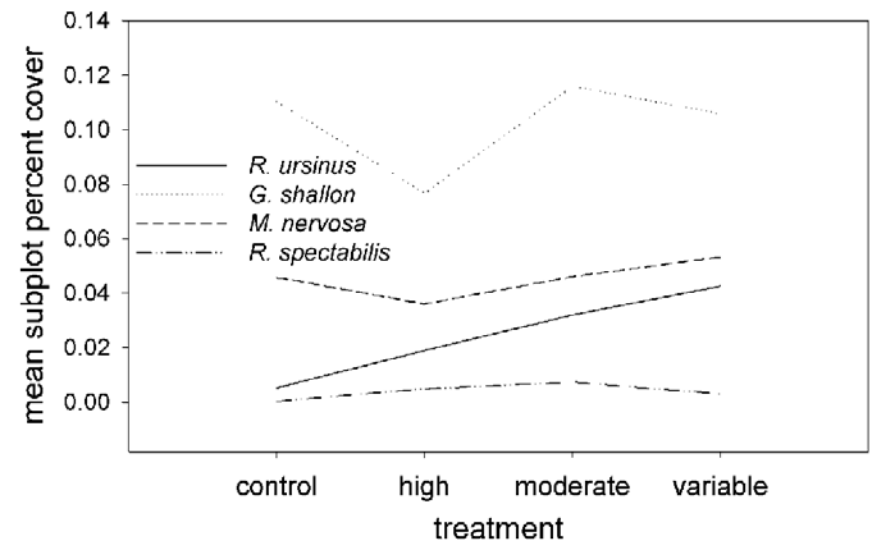
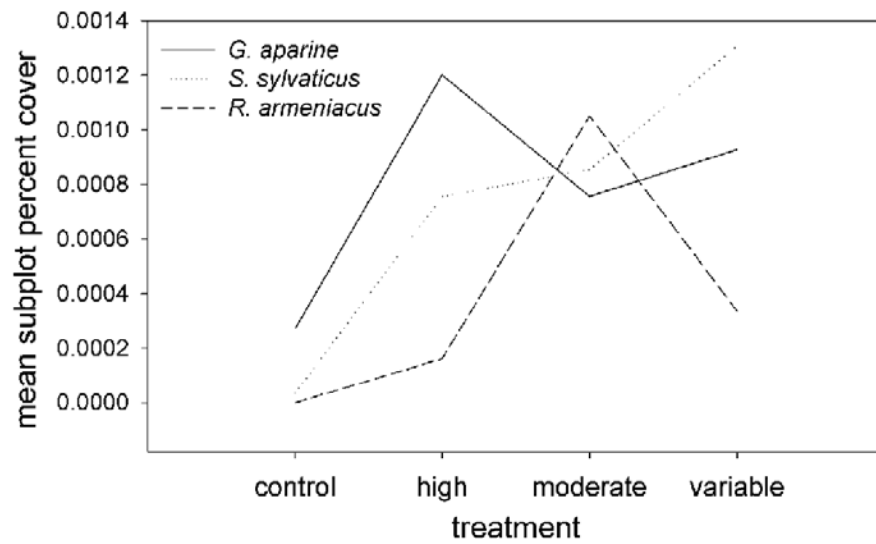


community diversity

questions?



relative abundance



CV of BA

