



Experimental field site (Spain):

 Rainfall: 300 mm⁻¹
 Patchy vegetation
 Goats and rabbits

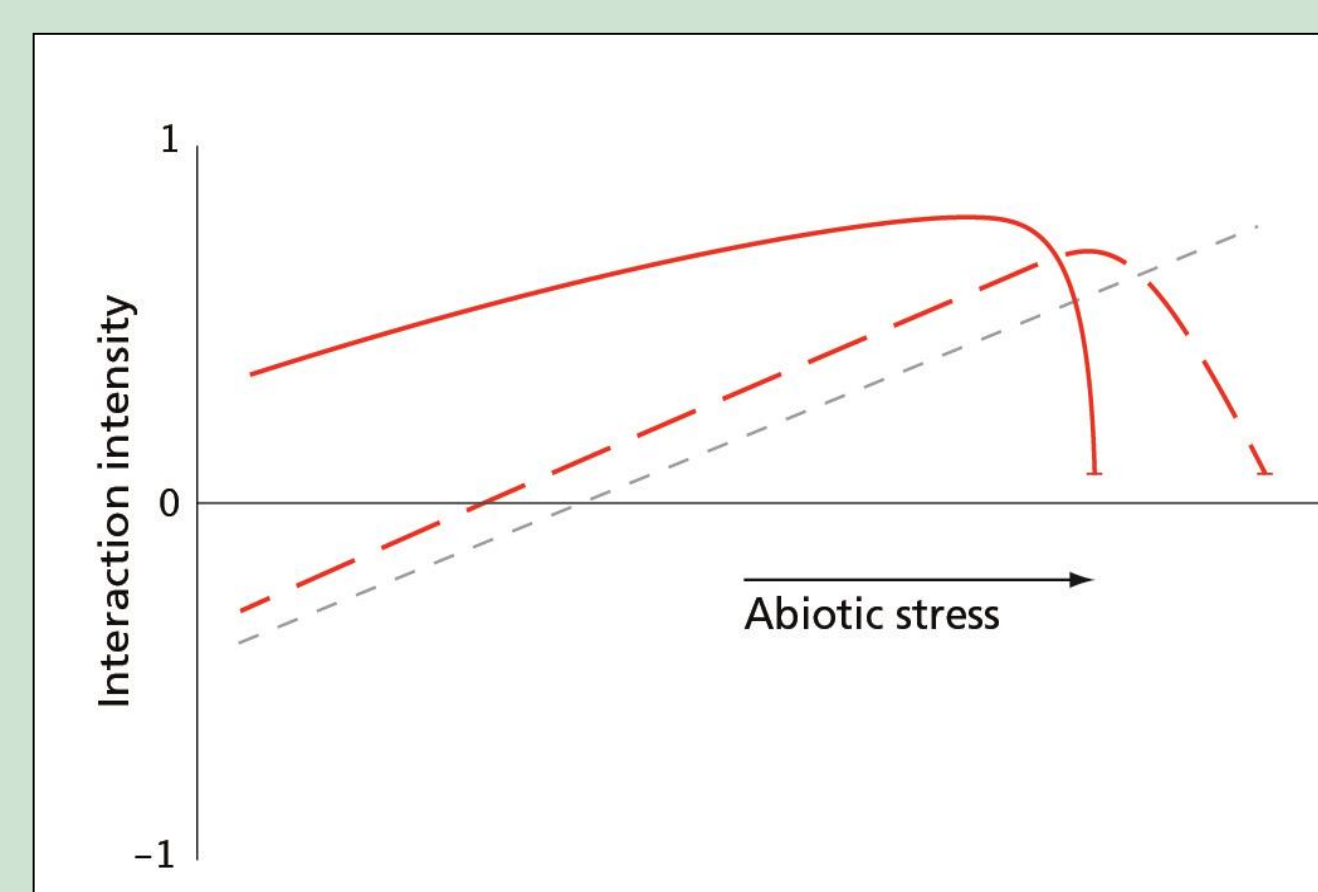

Positive plant interactions under drought and grazing stress

Stressing facilitation

Plants may facilitate neighbours by for example shading or protecting against herbivores. Changes in facilitation intensity may result in decreased ecosystems stability².



- + nutrients/infiltration
- +Shading
- +Protection against herbivores
- -Root competition



Stress Gradient Hypothesis:
 Increase in facilitation with higher abiotic stress (grey dotted line)

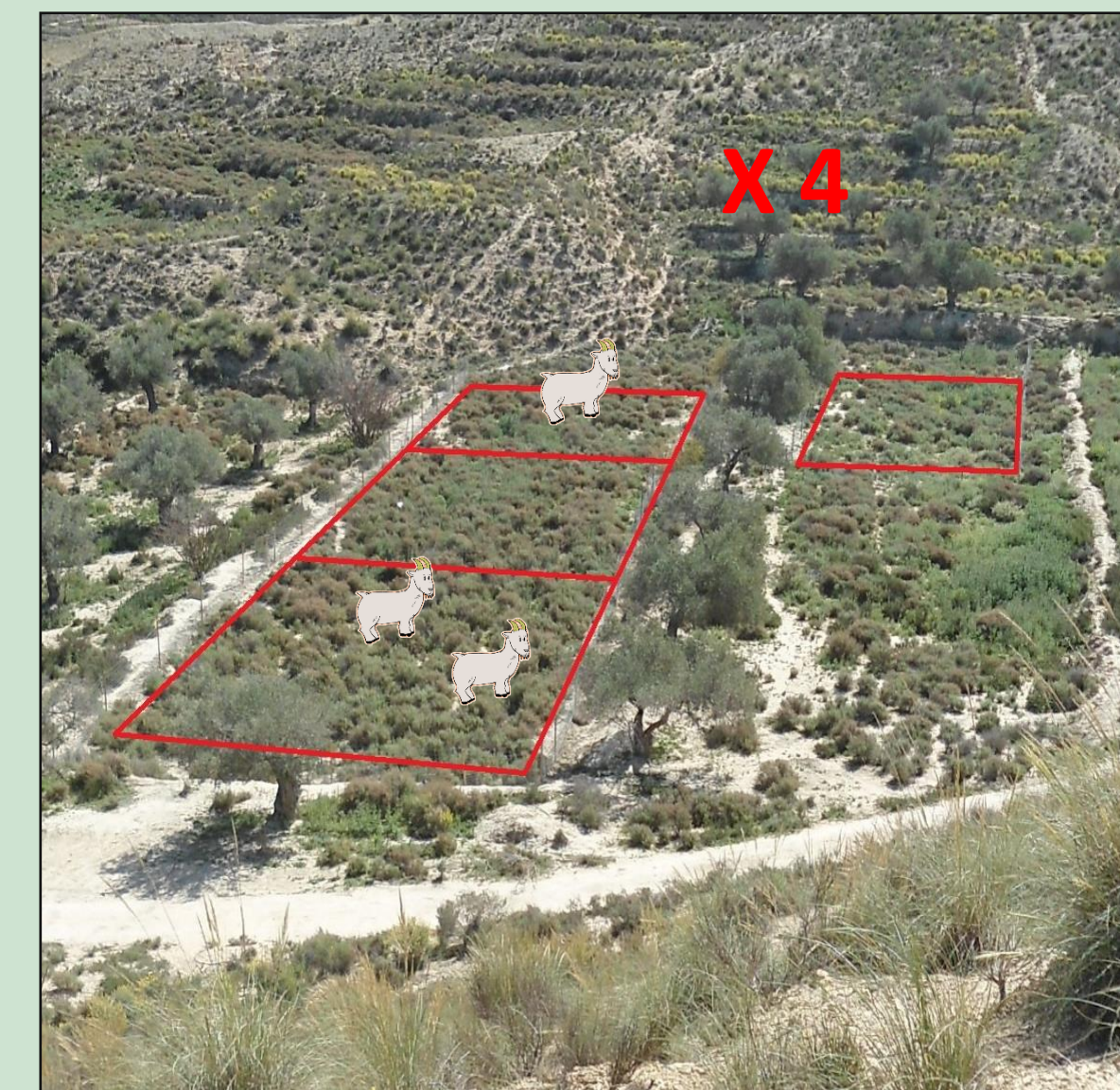
Revised SGH arid ecosystems¹:
 Increase in facilitation with higher drought stress, but at extreme drought facilitation wanes. (red dotted line)

Key knowledge gap: How do plant-plant interactions change when both drought and herbivory act simultaneously?

Hypotheses⁽²⁾:

Grazing increases the intensity of positive interactions, **but with extreme grazing, interactions become neutral** (solid line)

Experimental design



Within every plot we planted 40 saplings under a protecting shrub or sole standing:



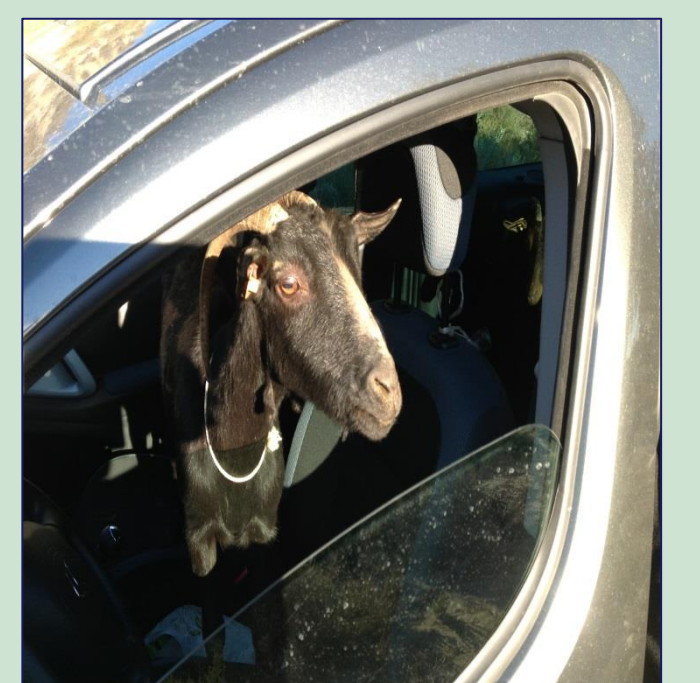
Protecting, unpalatable mature shrub (*Artemisia barrelieri*)

X 40

Highly palatable planted sapling (*Anthyllis cytisoides*)

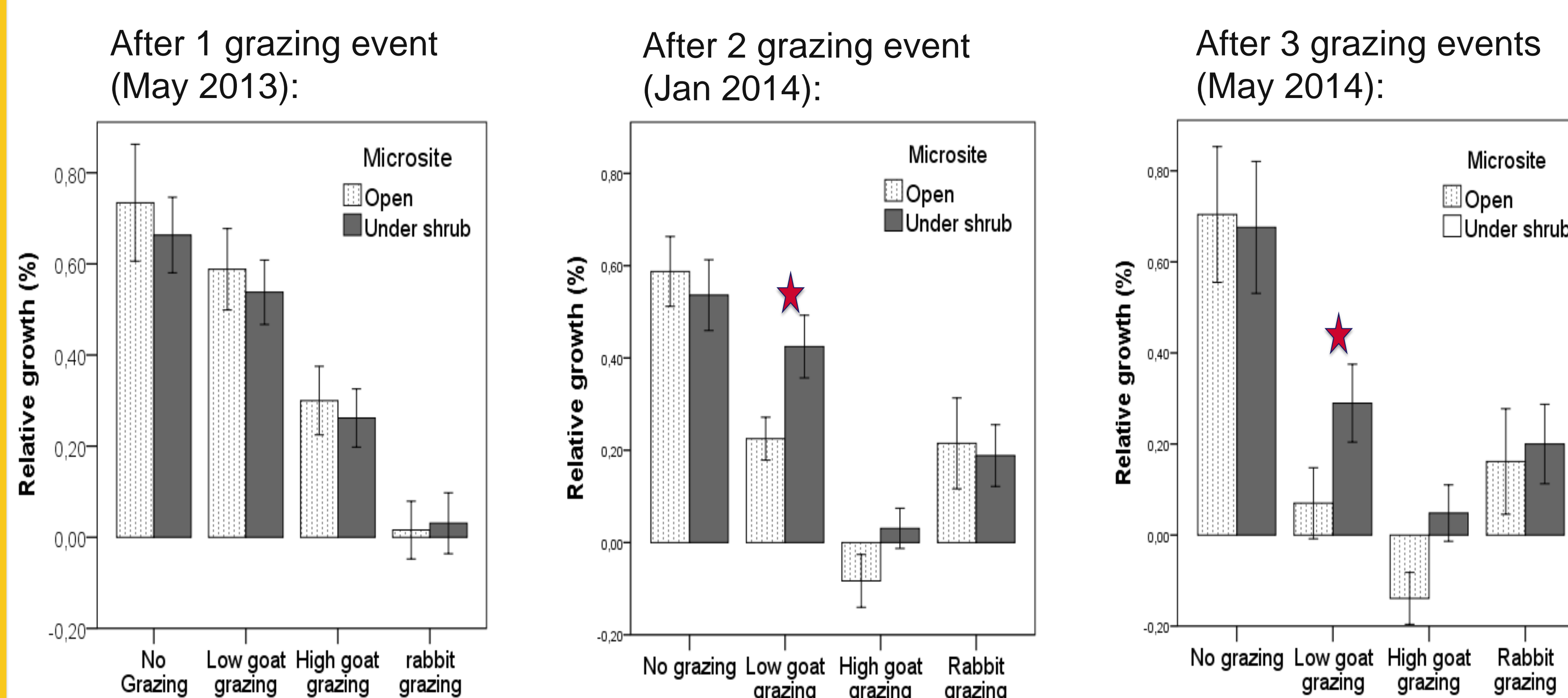
1280 *Anthyllis cytisoides* saplings were planted at four fenced terraces. Every fence was divided into four plots to mimic grazing levels. Ungrazed – low goat grazed – high goat grazed – rabbit grazed.

Grazing was simulated by putting either 3 or 6 goats within the enclosure for 6 hours. We repeated these grazing events three times



Survival, growth and grazing damage of planted saplings are monitored from January 2013 onwards.

Results : Low goat grazing results in contrasts in sapling height

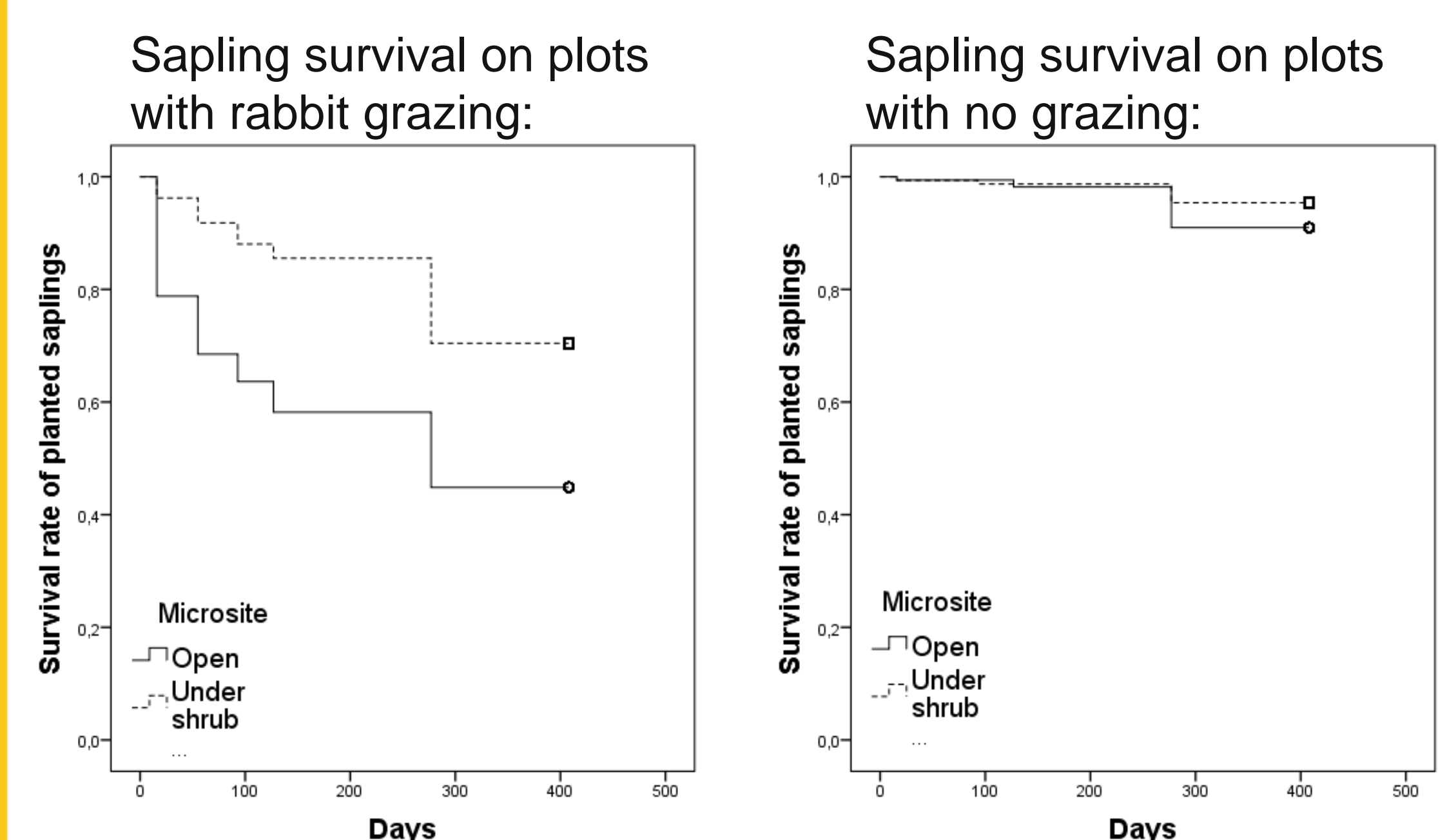


Grazing significantly reduced plant growth, but we found no differences between microsites for any of the grazing levels.

Significant effect of grazing*microsite. Higher saplings under shrubs for low grazing, but not for high grazing.

Similar pattern, positive interactions seems to evolve at high goat grazing.

Results : Rabbit grazing results in contrasts in survival



On rabbit grazed plots we found a higher mortality compared to plots that were ungrazed or grazed by goats. Survival is significantly higher under shrubs on plots that were grazed by rabbits.

General conclusions

The unpalatable shrub *Artemisia barrelieri* is an effective nurse species for palatable saplings, but protective effects are dependent on type and intensity of grazing. Positive interactions are most pronounced with low grazing (in height) and with rabbit grazing (in survival), but wane again but high grazing.

Challenges ahead

Linking small scale interactions between plants to spatial patterns and stability of systems

Linking observations from the field to (spatial) eco hydrological models