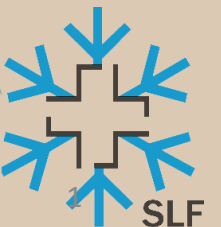


Disturbance effects on range limit populations and interspecific interactions



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Differential disturbance effects on *Silene acaulis* populations at contrasting elevational range limits

2
No disturbance effects on cushion-beneficiary interactions, which are competitive

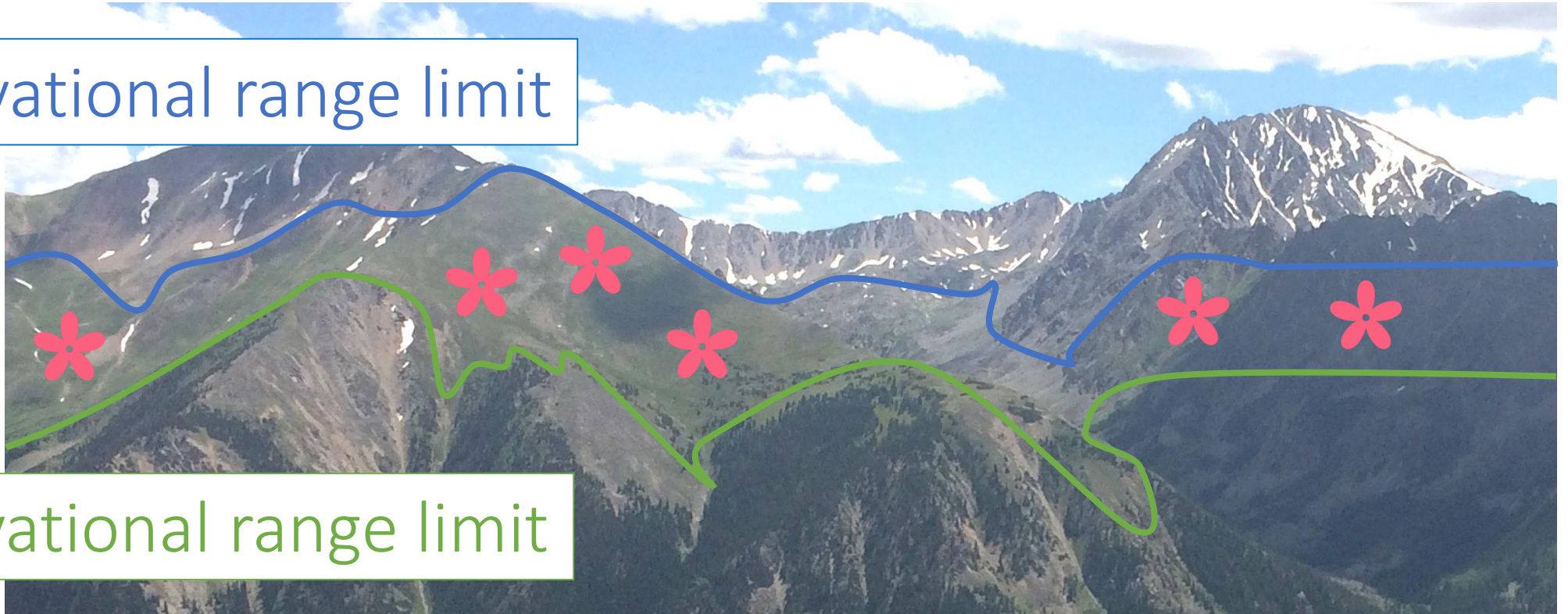


Silene acaulis (Caryophyllaceae)



Range Limits are edges of a **species'** geographic distribution

Upper elevational range limit



Lower elevational range limit

Set by **abiotic** factors in abiotically stressful areas & **biotic** factors in areas with low abiotic stress



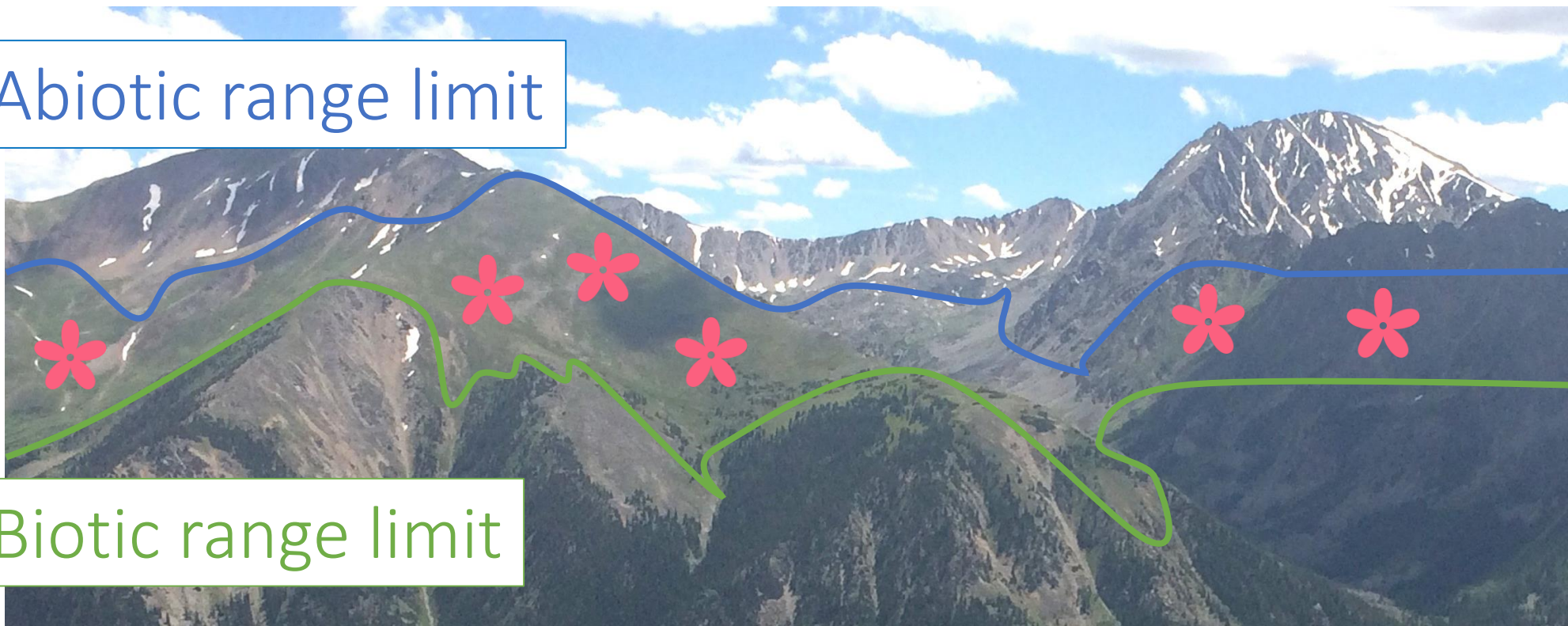
climate

Abiotic range limit

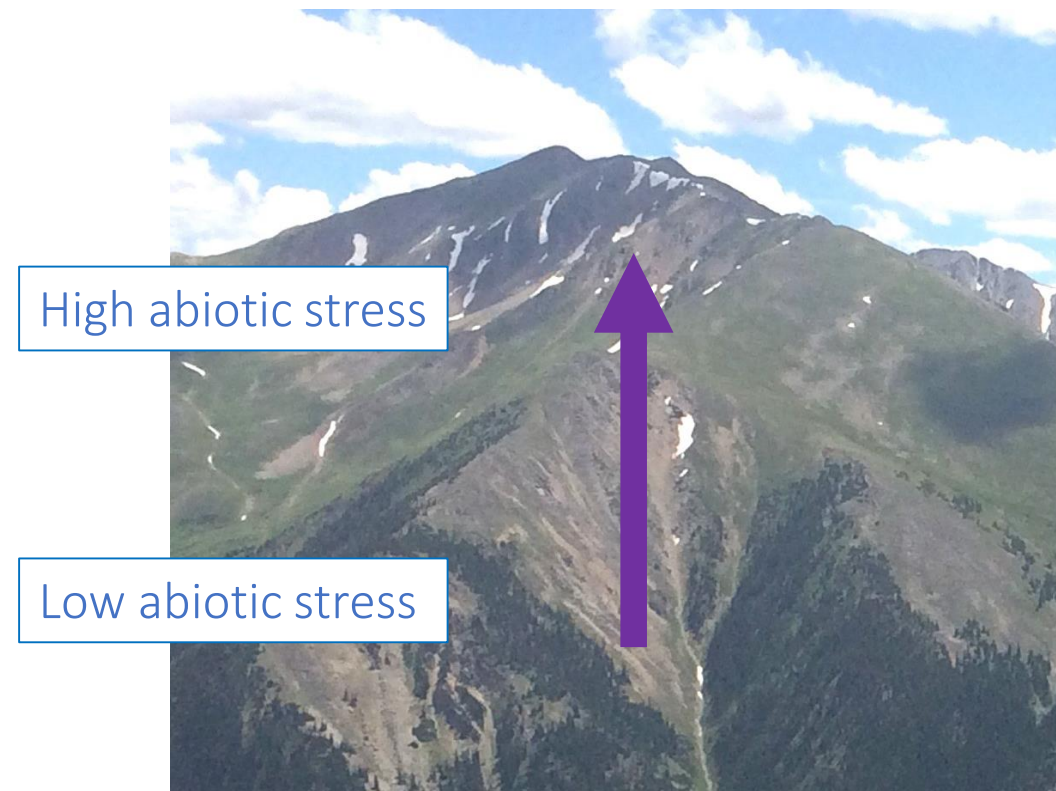


competition

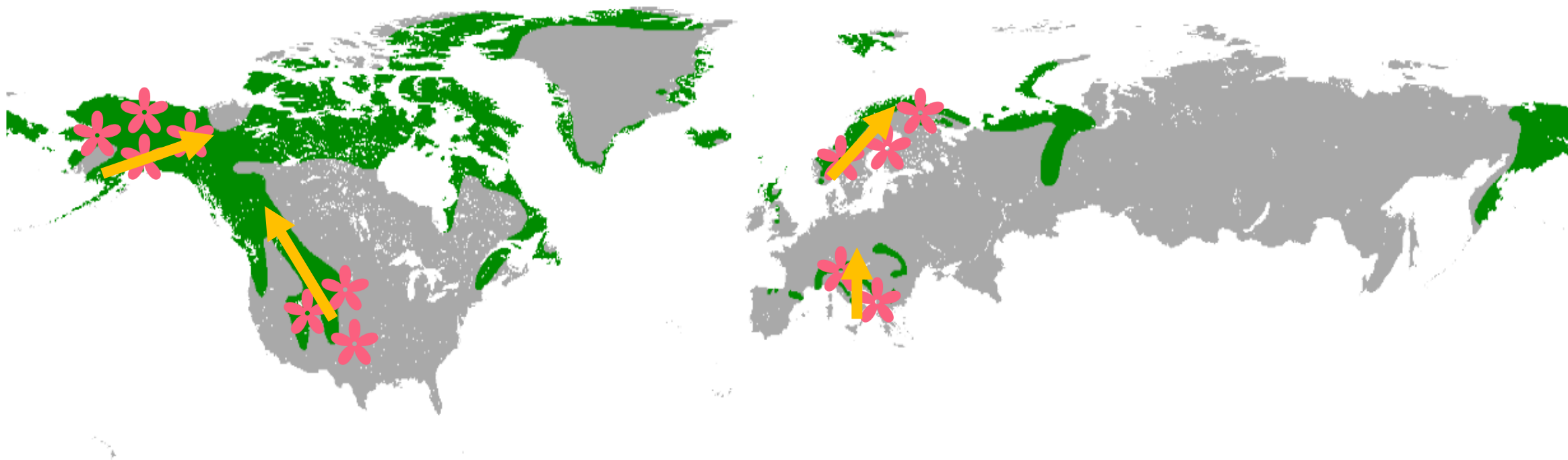
Biotic range limit



Facilitation can increase community species diversity and expand beneficiary species ranges



Predictions of **distribution shifts** with climate change based on assumptions of what causes range limits



How do local disturbances impact range limit populations and interspecific interactions?



Disturbance likely exerts contrasting effects at range limits determined by different processes



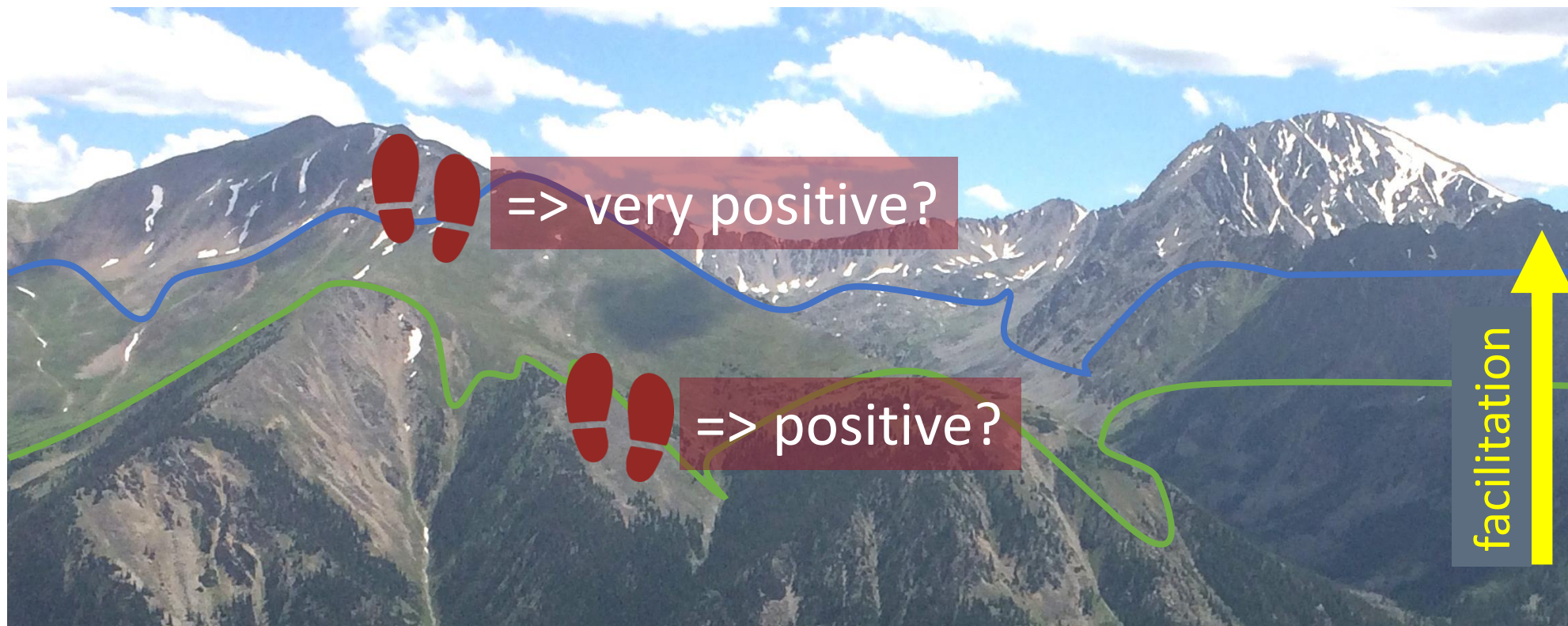
Abiotic limit



Biotic limit



Disturbance likely increases facilitation most in abiotically stressful areas



Surveys at disturbed (trail-side) and undisturbed (off-trail) plots at lower and upper elevational range limits

Colorado Rocky
Mountains
(3500 - 4270 m)



Swiss Alps
(1950 - 2680 m)



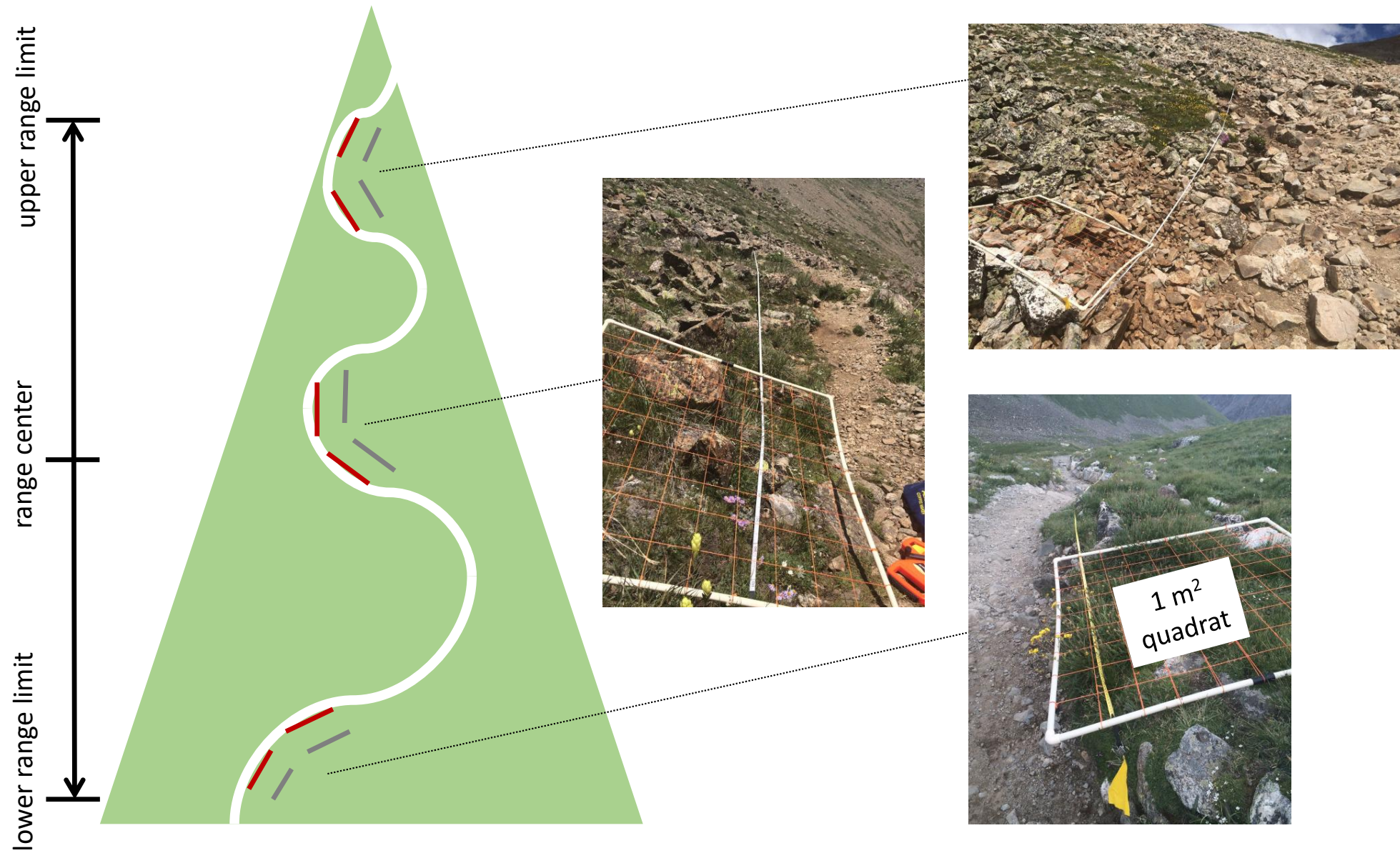
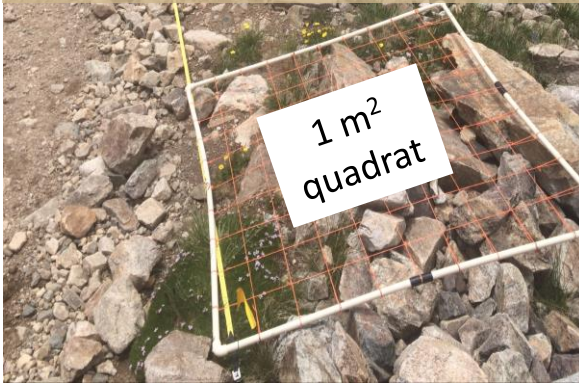


Fig. 2 modified from Chardon et al. 2019. J Appl Ecology, 56(6):1389-1399.

Neighboring vegetation



Maximum plant size



Plant density



Cushion-beneficiary plant interactions



Disturbance reduces potential competitive interactions by decreasing neighboring vegetation

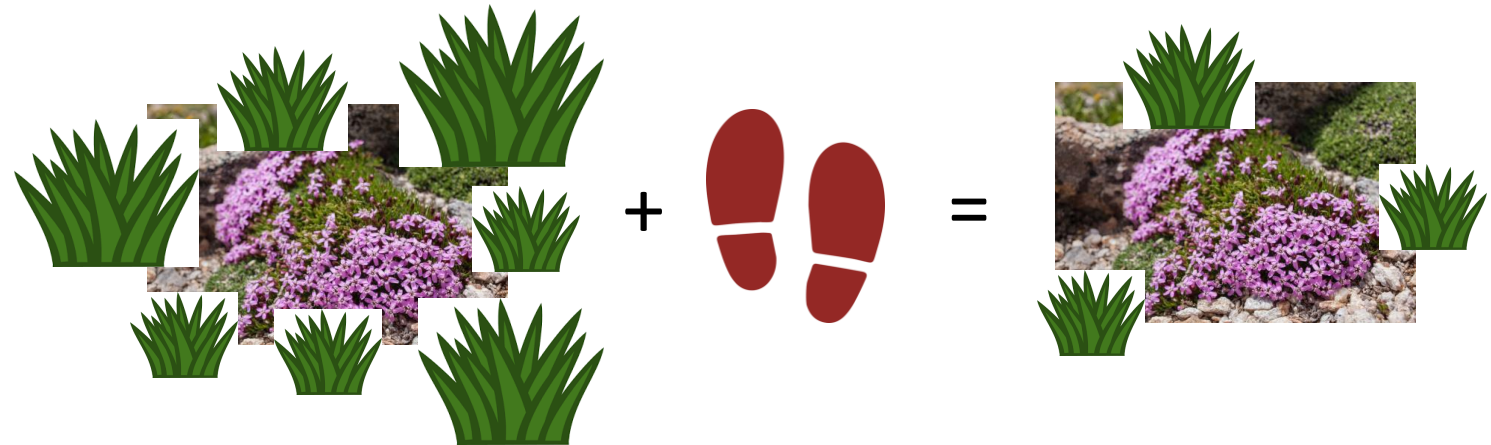
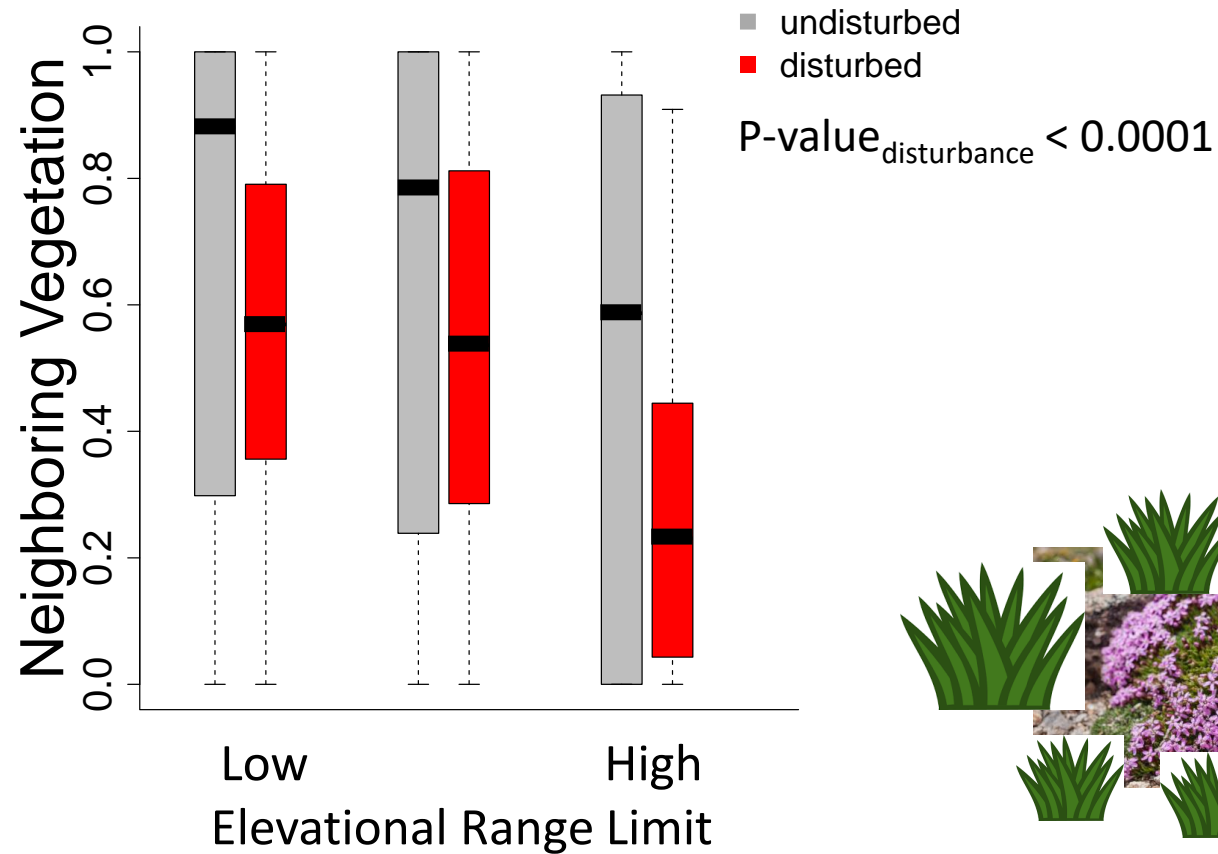


Fig. 4 modified from Chardon et al. 2019. J Appl Ecology, 56(6):1389-1399.

Disturbance increases cushion plant sizes at lower, but not upper, elevational range limits

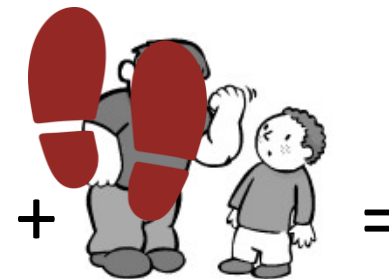
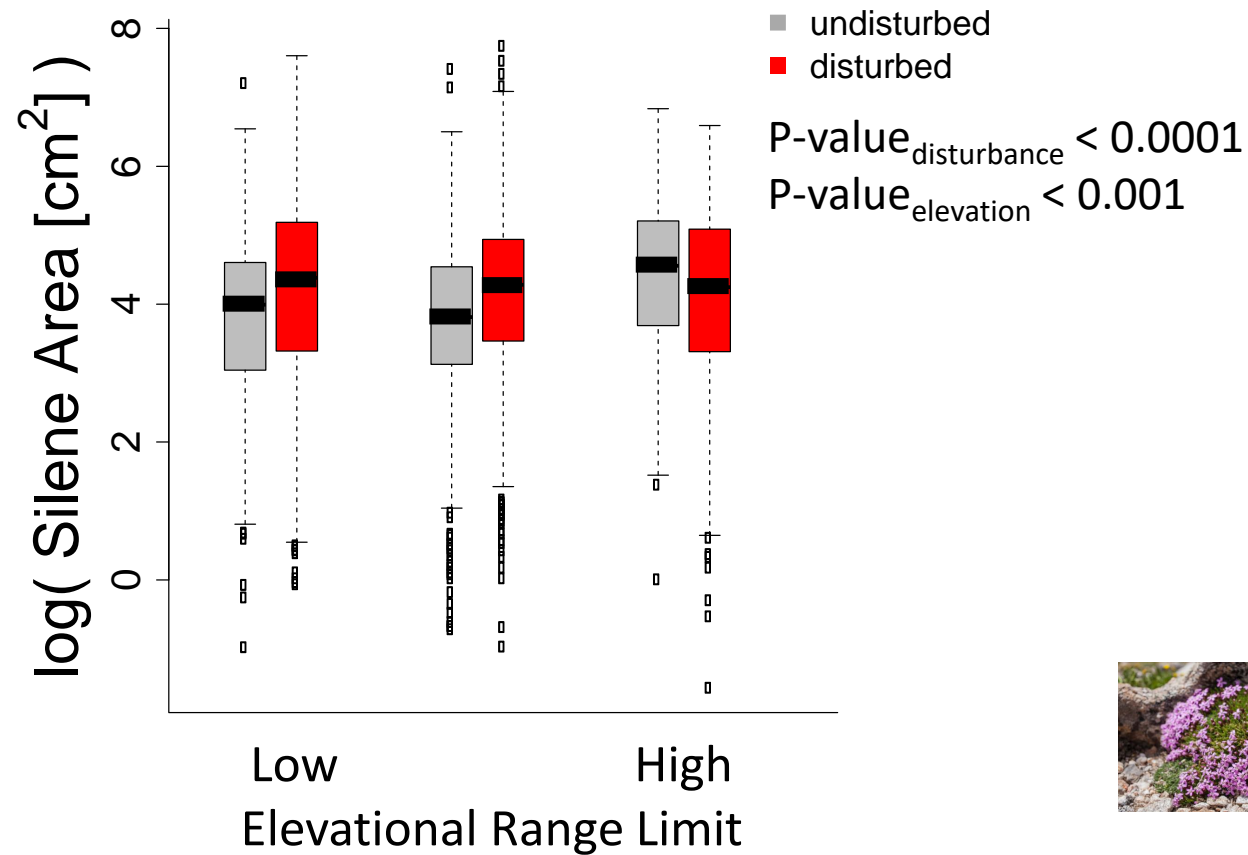


Fig. 3 modified from Chardon et al. 2019. J Appl Ecology, 56(6):1389-1399.

Disturbance also increases **density** at lower, but not upper, elevational range limits

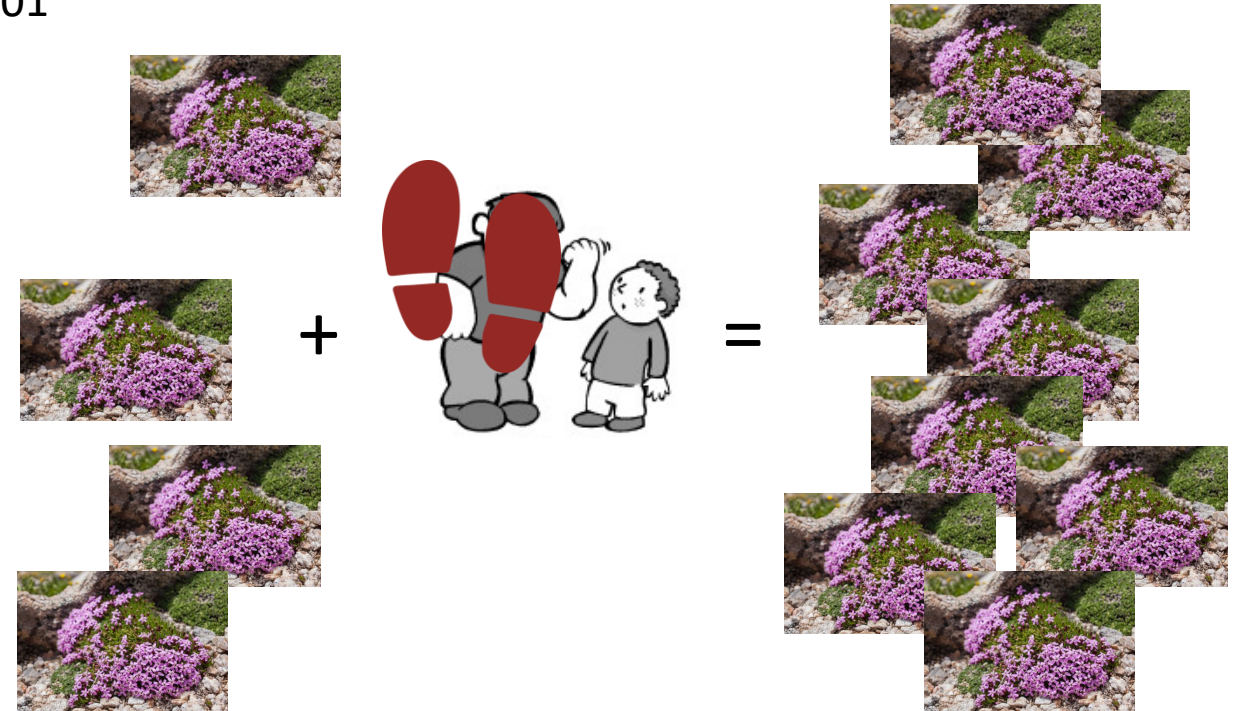
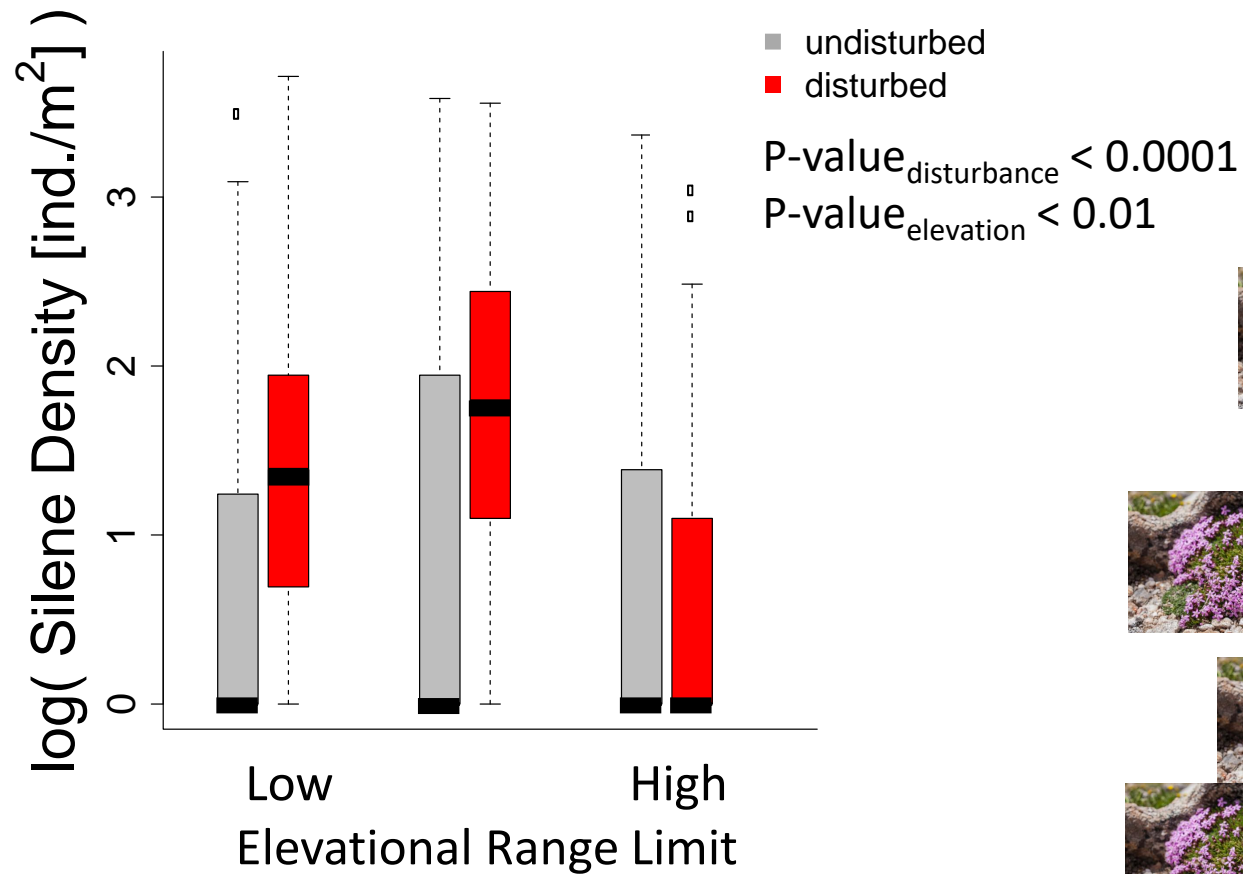
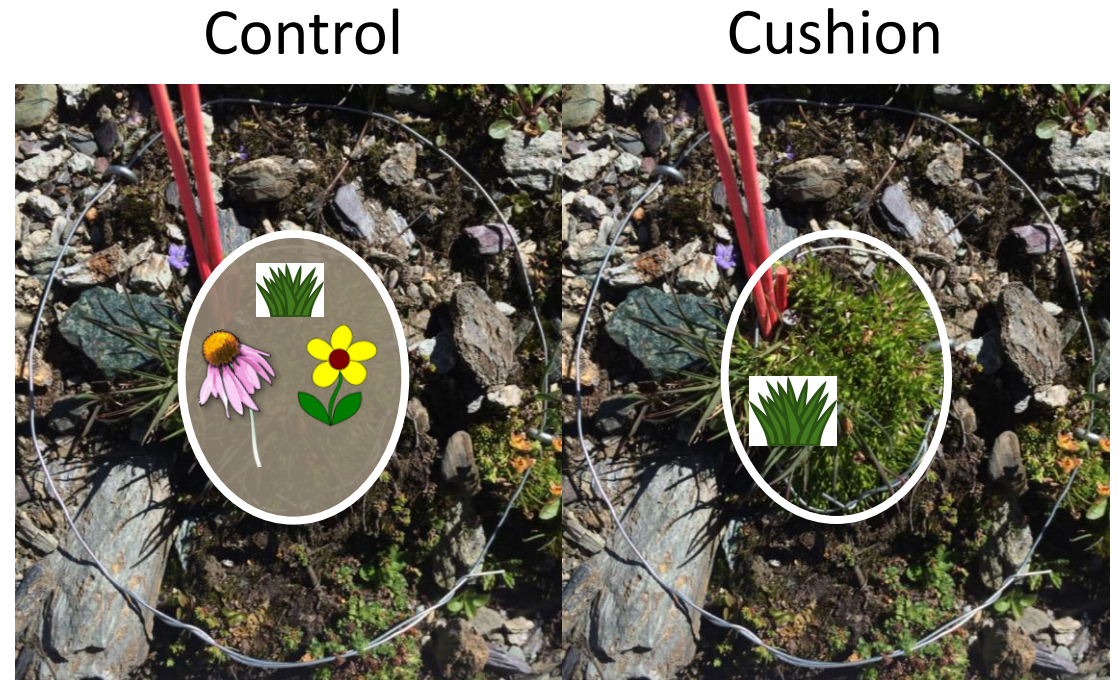
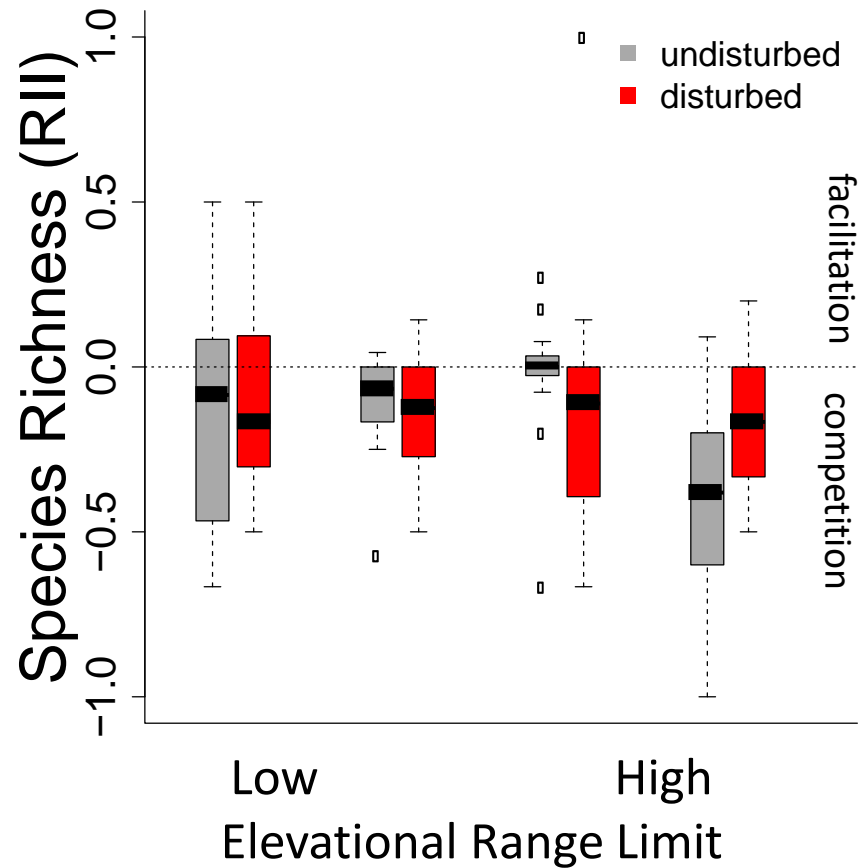
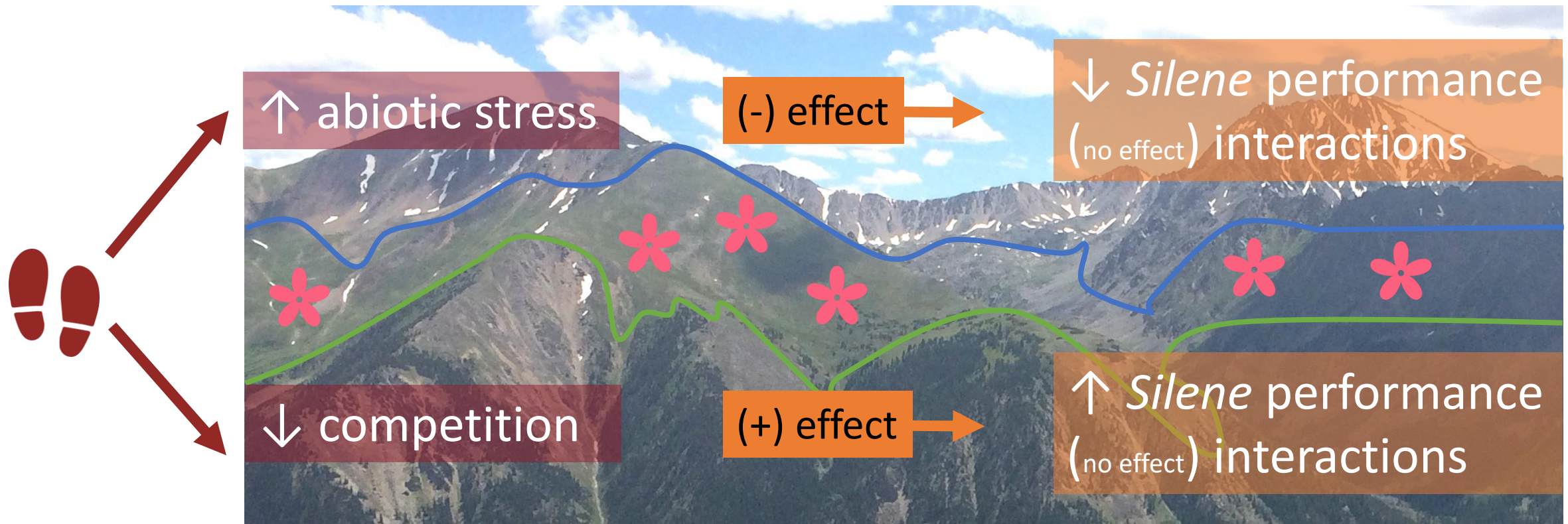


Fig. 3 modified from Chardon et al. (in revision, *J Appl Ecology*)

Cushion-beneficiary plant interactions are **competitive**, with no effect of disturbance



Disturbance exerts **direct** and **indirect** effects



Upper elevational range limits are set by abiotic factors,

and lower elevational range limits by biotic factors,

with no facilitative interactions in study system.

Use local disturbances to
stabilize range limits in
abiotically unstressful areas

Reduce disturbances at
abiotically stressful range
limits

