Effect of landscape structure and habitat quality on the populations of a short-lived perennial plant, *Salvia nemorosa*

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Fig. 3. The location of the study sites in the Great Hungarian Plain.

Introduction

Intensive agricultural practices may cause severe habitat fragmentation and isolation of populations. Kurgans (ancient burial mounds, Fig. 1a) represent small, island-like habitats that may act as refuges for species of the natural vegetation, such as the dry grassland species *Salvia nemorosa* (Fig. 1b). Investigating processes whereby the modified landscape structure and habitat quality jointly influence the various traits and the demographic performance of *S. nemorosa* populations may shed light on the mechanisms of species' local and regional persistence (Fig. 2).

Fig. 1a. Kurgan with S. nemorosa in the foreground.

Fig. 1b. Salvia nemorosa inflorescence.

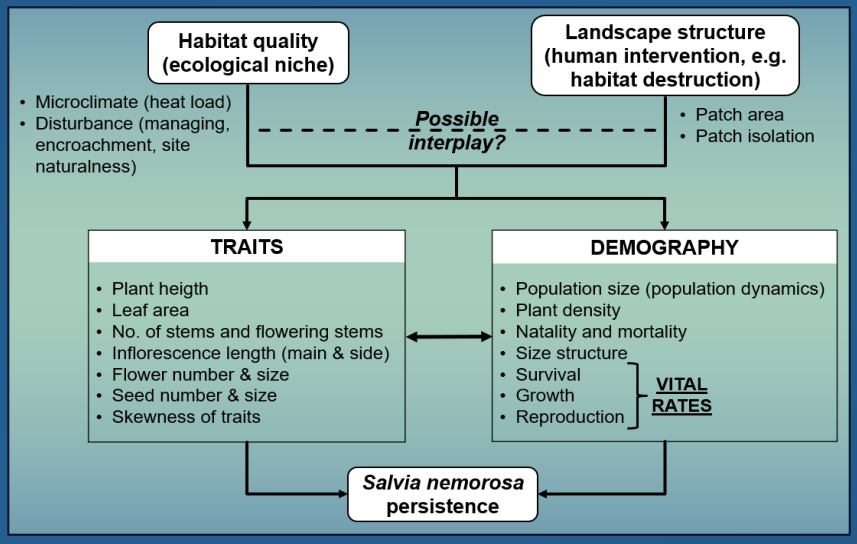

Fig. 2. Conceptual figure showing the potential effects of habitat quality and landscape structure on individual traits and demographic performance of Salvia nemorosa.

Research questions

1. How does the landscape structure interact with local habitat quality to modulate the local and regional persistence of *S. nemorosa*?
2. How do trait shifts caused by habitat quality and landscape structure affect the demographic mechanisms of persistence in *S. nemorosa*?

Methods

- Pilot study conducted in 2021 in the Great Hungarian Plain (Fig. 3), at 9 sites: seven kurgans and two flat areas.
- Permanent plots (0.5 m^2) set along 10 meter transects for demographic observations, census of the density and traits of tagged plant individuals.
- 14 transects, 206 plots, 356 plants measured, and 106 stems collected for laboratory analyses

Statistical analysis

Mixed effects models (LMM / GLMM) in R.

- Examples:

LMM: ***(inflorescence length ~ heat load + (1|site) + (1|plant_id), REML= FALSE, data = data1)***

GLMM: ***(plant density ~ heat load + (1|site), family = "poisson", data = datahload)***

Conclusion

Preliminary results suggest that the quality of the remaining habitat fragments might be critical for the persistence of short-lived perennial plants in severely fragmented landscapes.

Results

- Heat load had a significant positive effect on plant density (Fig. 4), a significant, negative effect on leaf area (Fig. 5) and it did not have a clear-cut effect on inflorescence length (Fig. 6).
- We did not find any effect of habitat area on plant density (*p>0.1; R^2 m= 0.020*), leaf area (*p>0.1; R^2 m= 0.080*) and inflorescence length (*p>0.1; R^2 m= 0.290*).

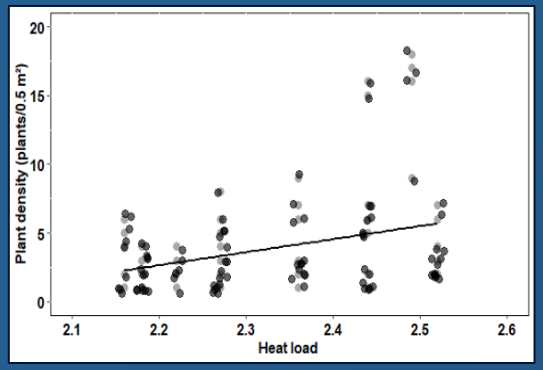

Fig.4. The effect of heat load on plant density. (p=0.030; R^2 m= 0.226)

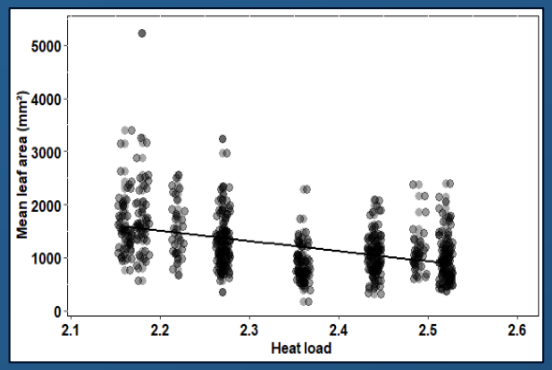

Fig. 5. The effect of heat load on leaf area. (p=0.002; R^2 m= 0.164)

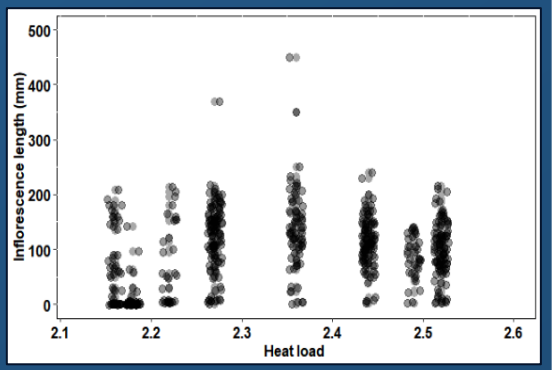

Fig. 6. The effect of heat load on inflorescence length. (p=0.318; R^2 m= 0.020)