

Factors influencing *Robinia pseudacacia* invasion of dry grasslands and forests in the Austrian Wachau region

Michael Glaser^{1,3}, Thorsten Englisch^{1,2}, Josef Greimler¹

¹ University of Vienna, Department of Botany and Biodiversity Research
² V-P-N, Vegetationsökologie, Populationsökologie, Naturschutzforschung
³ corresponding author

Background

Robinia (pseudacacia) was introduced into the Wachau region 150-200 years ago for economic purposes and presents an ideal case-study:

- naturalized and still expanding throughout the region
- amongst the most detrimental invaders to dry grassland habitats in Austria
- a LIFE+ project focussing on dry grassland preservation was completed 10 years ago
- no economic planting currently in the region

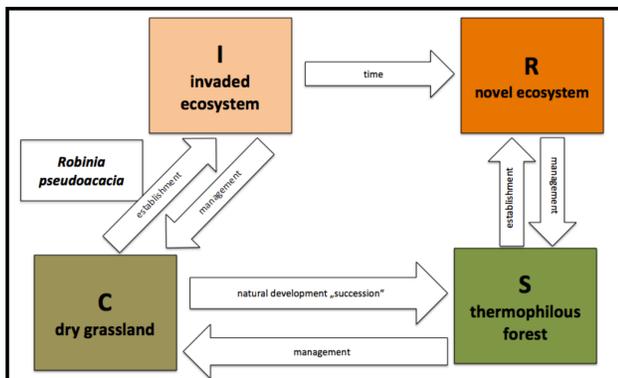


Figure 1: Novel ecosystem development under invasion was used to define sampling strata

Method

From March-July 2016 vegetation coverage of vascular plants as well as environmental factors recorded for each plot:

- soil (depth, major grain type)
- hemeroby (distance to settlements etc.)
- heat load index (elevation, aspect, slope)

Additional data for these sites were obtained:

- management data
- historic land use (Franzis'zeischer Kataster)

Data were analyzed by:

1. clustering
2. NMDS (non-metric multidimensional scaling)
3. MRT (multivariate regression tree)
4. Ellenberg Indicator values and measures of diversity on terminal MRT nodes

Results

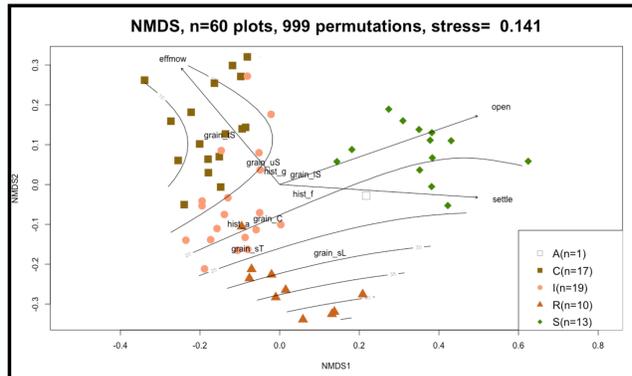


Figure 2: NMDS displaying most clear associations between stratified samples and environment

- grain_ (soil grain type: s... sandy, l... loamy, u...silty)
- hist_ (historical use as a... agriculture, g... grassland, meadow or pasture, f... forest)
- open (percentage of open soil)
- effmow (amount mowing events in last 10a)
- settle (distance to settlement as indicator of hemeroby)

Note that C-stratum tends more to shallow sandy soils and sites under historical and present agricultural use tend to be associated with the R-stratum.

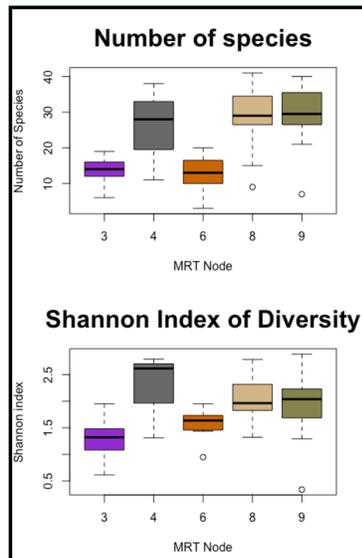


Figure 4: Diversity of the terminal MRT nodes are expressed as number of species and Shannon Index of diversity.

Note the initial lag of the diversity drop-off from nodes 9 to 8 to 6 as well as the equally low diversity of nodes 3 and 6 compared to node 9.

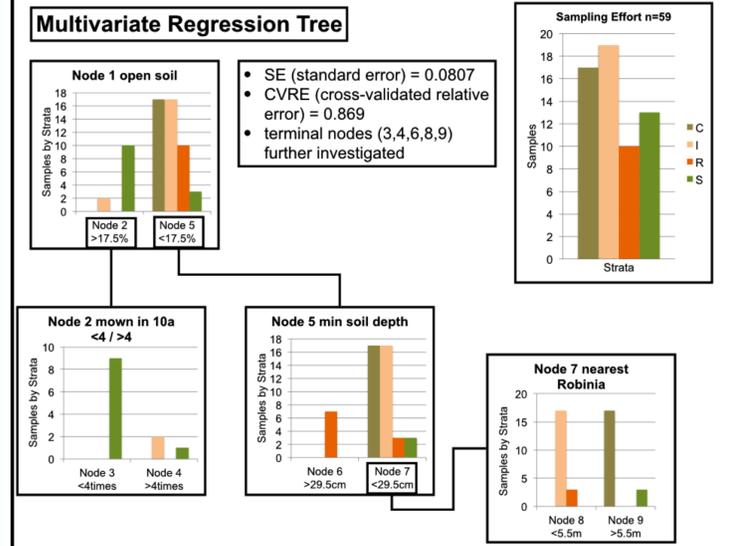


Figure 3: MRT nodes illustrated with splits and strata, boxes denote nodes further split, unboxed nodes are terminal nodes; top right shows overall sampling effort for MRT.

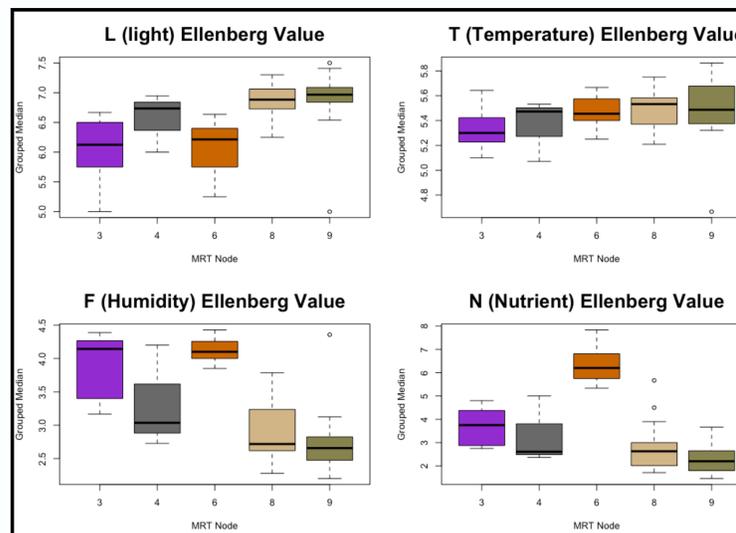


Figure 5: Ellenberg Values of the terminal MRT nodes, grouped median was used to calculate node averages.

Note the change in the F indicator from node 9 to 8 to 6 compared to the N indicator, especially compared to node 3.

Conclusion

- NMDS stress and MRT error(s) are high. Both could be improved with a greater sample size and/or different environmental predictors.
- *Robinia* stands in close proximity to dry grassland sites act as sources of reinvasion via root suckers. Invasion via seedlings seems rare.
- Initial drop-offs in diversity are masked by collateral invasions of species that can only grow under invasion pressure by *Robinia*.
- A lag in nutrient accumulation makes sites of early invasion a good target for management efforts – early establishment monitoring is needed.
- Forest fringes and ecotones with dry grassland are overgrown by *Robinia*.
- Forest undergrowth shows presence of *Robinia* seedlings throughout the area and when light gaps form they close the canopy quickly.

Funding

This study was partially funded by:

- University of Vienna
- Lower Austrian Provincial Government (ID: RU5-A-60/009-2016)
- Association "Wachau-Dunkelsteiner Wald Regionalentwicklung"

Contact Information

Michael Glaser, MSc
 glasermichael514@gmail.com