Species richness of neophytes, archaeophytes and native taxa on a landscape scale in Switzerland

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In Europe, in addition to differentiating between native and non-native vascular plant species, the latter are usually further classified into archaeophytes and neophytes, depending on the date of their arrival before or after the discovery of America. Neophytes and archaeophytes are considered by many to have quite different values and functions in ecosystems. This research investigates how the species richness of both groups differ at the landscape scale and how their richness patterns are related to those of native plant species.

Data

- Study area: Switzerland
- Distributional data: From the Swiss Biodiversity Monitoring Program (www.biodiversitymonitoring.ch). Species richness in landscapes is surveyed in 1km^2-plots on a systematic national grid and species lists are generated for each plot by standardized transect sampling (Fig. 1; Plattner et al. 2004). For the analysis we used 455 plots with 104,464 occurrences of 1767 vascular plant species recorded between 2001 and 2006.
- Classification of native and non-native taxa: Follows Landolt et al. (in prep.)
- Environmental variables: Topography, climate, substrate, geology and land cover (N=60; for detail see Wohlgemuth et al. 2008).

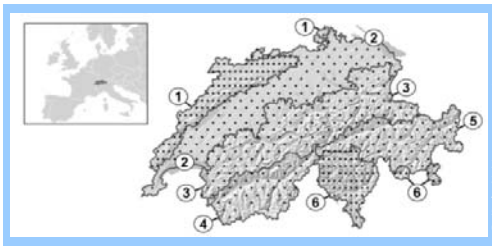

Figure 1 Study area and locations of plots

1=Jura, 2=Central Plateau, 3=Northern Prealps, 4=Western Central Alps, 5=Eastern Central Alps , 6=Southern Alps

Methods

- Modelling: Generalized linear models (GLM) to relate transect species richness environmental variables (linear and quadratic terms). Variable selection was based on Akaike`s Information criterion (AIC) and explained deviance (D^2). For details see Wohlgemuth et al. (2008).
- Predicted richness maps: Built for each species group by applying the final GLMs nationwide in a 1km^2 moving window with a 100m step.

Results

- Along the elevational gradient non-native species have the highest richness in the lowlands, archaeophytes being more speciose than neophytes in all elevations and diminishing more slowly towards higher elevations (Fig. 2).
- Native species richness shows a clear mid-elevational peak, which is not detectable for non-natives.
- Models for non-natives contain fewer variables than models for natives, capturing a greater explained deviance (D^2). Neophyte richness, in particular, can be predicted with a very simple model containing only two variables but with high predictive power (Table 1).
- In contrast to the richness of natives, urban land use (L.urban) is an important variable for both archaeophytes and neophytes (Table 1).

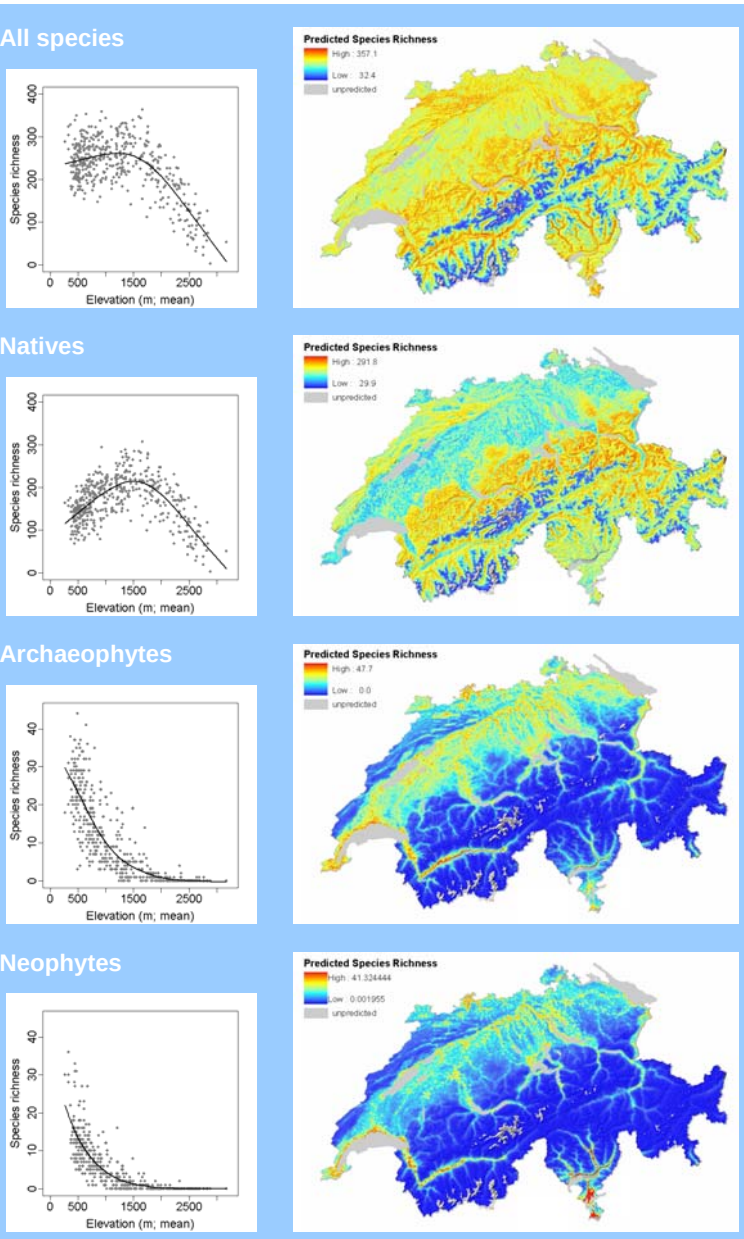

Figure 2 Scatter plots showing species richness against average elevation and predicted species richness maps for four species groups

Table 1: Final GLMs for the four species groups

	Variables	D^2
All species	E.min + SILI + TR.ran + CRE.avg + L.forest + L.agrilow + L.bare	0.745
Natives	E.avg + TY.avg + SILI + TR.ran + CRE.avg + L.forest + L.agrilow + L.bare	0.749
Archaeophytes	PY.max + R3.avg + TY.avg + L.agrilow + L.urban	0.852
Neophytes	TY.avg + L.urban	0.832

Conclusions

- Neophytes and archaeophytes show similar species richness pattern, which are significantly different to native species.
- As the distributions of neophytes spread, this close relationship between neophytes and archaeophytes support the idea that the richness patterns of both groups may even become more similar in the future. In this case the present-day distribution of archaeophytes may be used as a rough proxy of the future distribution of neophytes.

References

Landolt, E. et al. (in prep.): Ökologische Zeigerwerte und biologische Kennzeichen zur Flora der Schweiz und der Alpen.
Plattner, M., Birrer;S. & Weber, D. (2004): Data quality in monitoring plant species richness in Switzerland. Community Ecology 5(1): 135-143
Wohlgemuth, T., Nobis, M.P., Kienast, F. & Plattner, M. (2008): Modelling vascular plant diversity at the landscape scale using systematic samples. J. Biogeogr. 35 (7): 1226-1240