Ecological Indicator Values for Europe (EIVE): recent developments and performance tests

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Ecological Indicator Values for Europe (EIVE): recent developments and performance tests

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Introduction

In Europe, **ecological indicator values (EIVs)** of plants are a very widely and successfully used **tool for bioindication**. The idea is to combine the expert-based assessment of the niche optima of species along certain niche dimensions, such as soil moisture or pH, and averaging them across all species in a community predicts its position in ecological space. Having been independently "invented" by Heinz Ellenberg and L.G. Ramensky, similar approaches were later implemented in many regions of Europe for various niche dimensions. Meanwhile, there are more than 30 such systems, varying in scaling and taxonomy, thus impeding analyses at a continental scale.

This prompted two author teams in January 2023 to release supra-regional indicator value systems for Europe, the **Ellenberg-type indicator values** by Tichý et al. (2023: "Tichý") and the **Ecological Indicator Values for Europe (EIVE) 1.0** (Dengler et al. 2023; Figs. 1 and 2). While their basic idea is similar, there are many differences in the details (see Box).

EIVE 1.0 vs. "Tichý"

- **Based on 31 (EIVE) vs. 12 ("Tichý") source EIV systems**
- **5 niche dimensions (EIVE), additionally salinity ("Tichý")**
- **Uniform scale of 0–10 (EIVE) vs. different scales for each dimension ("Tichý")**
- **14,835 (EIVE) vs. 8,679 ("Tichý") accepted taxa**
- **Covering entire Europe (EIVE) vs. nemoral Europe and Italy ("Tichý")**
- **Only EIVE has also indicators of niche width**

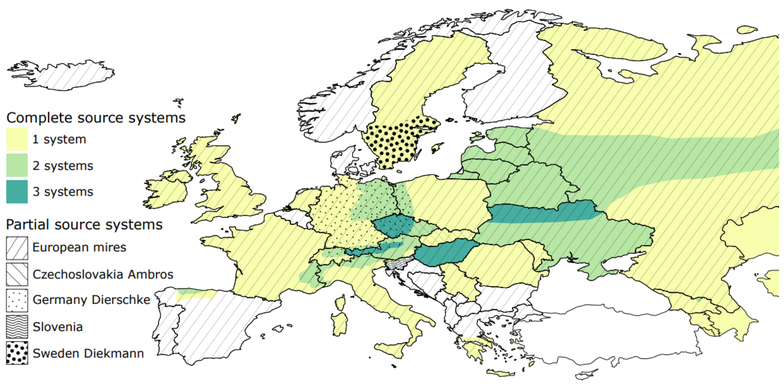

Fig. 1. Spatial coverage of source systems of EIVE 1.0.

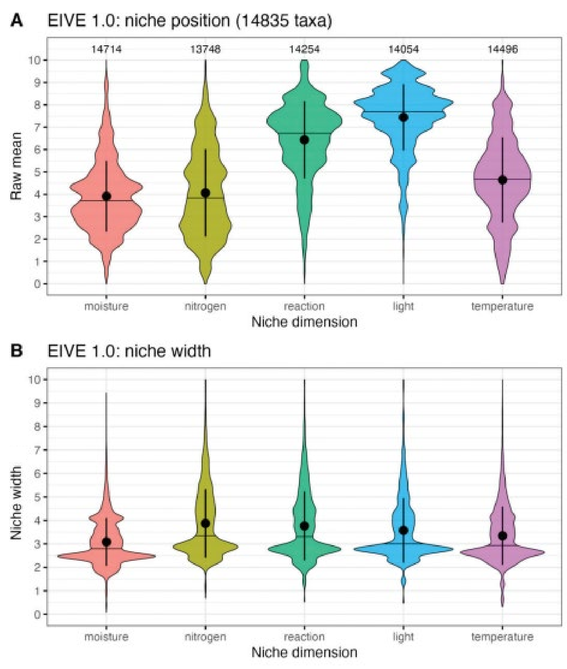

Fig. 2. Niche position (A) and niche width (B) distribution of the five niche dimensions in EIVE 1.0.

Performance of the two systems

We used three regional datasets covering long environmental gradients (one for temperature, two for pH) with measured environmental variables to compare the relative performance of EIVE 1.0, Tichý et al. (2023) and the two EIV systems valid for Switzerland, "Landolt" and "Ellenberg", and did this with four weighting approaches (Aicher et al. in review). **EIVE outperformed all other systems**, but particularly "Ellenberg" and "Tichý", while no cover-weighting was better than cover-weighting or sqrt (cover)-weighting. Only inverse niche width, solely available for EIVE and "Landolt", was minimally and non-significantly better than no weighting (Fig. 3).

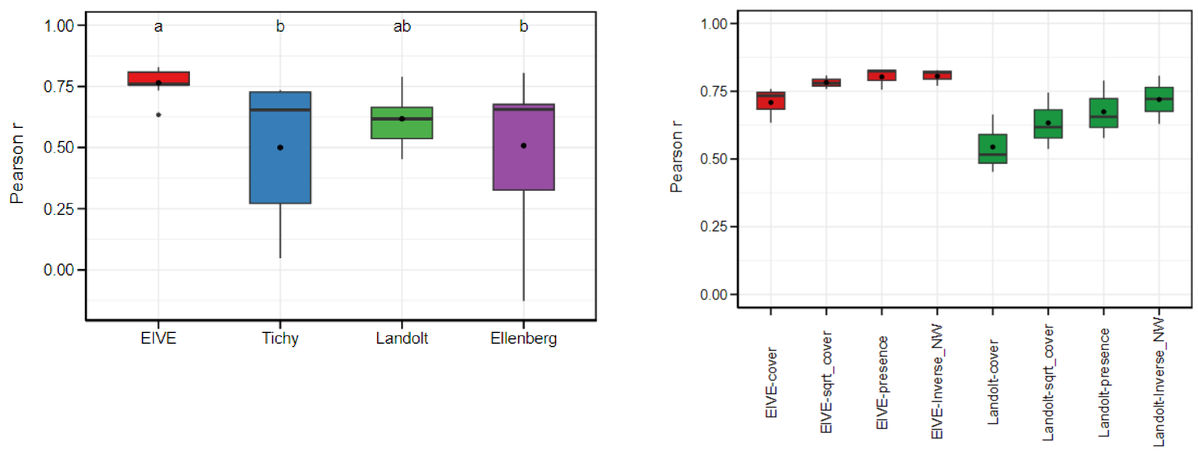

Fig. 3. Relative performance of four EIV systems and four weighting approaches in predicting measured environmental variables, expressed by Pearson's *r* in various datasets, tested with mixed-effect models. The points inside the boxes are the arithmetic means. NW = niche width.

Future developments of EIVE

Currently, we are preparing **EIVE 1.5** (Chusova et al. in prep.). This version will stay with the same five niche dimensions, but **add bryophytes, lichens and algae** plus new and updated EIV systems of vascular plants. This version to be released in a few months will increase the EIVE coverage to **approx. 20,000 valid taxa** (Table 1).

Table 1. Work status of EIVE 1.5 (as of 10 September 2024).

Taxon group	Vascular plants	Bryophytes	Lichens	Algae	All groups
Lines	99,080	12,208	4,374	77	115,739
Matched names	16,534	1,613	0	0	18,147
Non-matched names	824	1,632	1,801	58	4,315
Total names	17,358	3,245	1,801	58	22,462
Mean sources per name	5.7	3.8	2.4	1.3	5.2
Estimated valid taxa	16,699	1,939	1,441	46	20,125
Mean sources per taxon	5.9	6.3	3.0	1.7	5.8

EIVE is a **collaborative, community-based endeavor**, and we envisage already future development steps:

- **EIVE 1.7:** addition of further niche dimensions (e.g. salinity, humus content, CSR strategies)
- **EIVE 2.0:** using the EVA database to recalibrate and expand EIVE
- **EIVE 3.0:** release of regional/subcontinental EIVE editions

Conclusions

- **Use EIVE both in regional and continental studies (at least for R and T indicators)**
- **Don't weight the species by cover, but potentially by inverse niche width**
- **Join the EIVE consortium if you have ideas for further development or testing**

References

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