How to compute a Habitat Suitability map without absence data? Use the Ecological Niche Factor Analysis (ENFA)!

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(1) Habitat Suitability (HS) maps are commonly built on presence/absence data, but the latter are most generally unavailable or unreliable.

(2) Ecogeographical variables (EGV)

The EGV describe environmental, topographical and anthropic parameters of the study area.

(3) Presence data

Only presence data are needed. This makes ENFA particularly robust to the quality of data.

(4) Ecological Niche Factor Analysis (ENFA): Marginality and Specialisation

The ENFA’s principle is to compare EGV distribution for the presence data set (species distribution) to that of the whole area (global distribution).

Like the Principal Component Analysis, the ENFA summarises many EGV into a few uncorrelated factors retaining most of the information. But here, the factors have an ecological meaning.

4a. Marginality Factor

It is the direction on which the species niche differs most from the available conditions in the global area.

It is computed by drawing a straight line between the centroids of the global- (yellow) and the species (blue) distribution.

4b. Specialisation Factors

Once the marginality has been removed, a specialisation factor can be extracted by computing the direction that maximises the ratio of the variance of the global distribution (yellow) to that of the species distribution (blue).

It is then removed and this procedure is repeated until all the information has been extracted. At the end, most of it is accounted for by a few of the first factors and only those will then be used.

(5) HS map computing

The species distribution on the factors allows to compute a HS index for any set of EGV values and thus to draw the HS map.

(6) Download Biomapper

The software package Biomapper encompasses ENFA and many tools needed to prepare and explore the EGV maps, as well as evaluate the HS map. It is freely available at the following URL:

www.unil.ch/biomapper/