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## Supplementary variables (unconstrained ordination)

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### R functions

- `envfit` (vegan) - fits supplementary variables on ordination scores, using multiple regression. Tests the significance of each variable using permutation test<sup>1)</sup>. Results can be plotted onto ordination diagram using `plot` function; use argument `p.max` if only significant variables should be plotted. This function is a wrapper for functions `vectorfit` and `factorfit` applied on quantitative or qualitative environmental variables, respectively.
- `scores` (vegan) - extract scores of samples or species on ordination axes.
- `ordisurf` (vegan) - projects supplementary environmental variable as a non-linear surface onto ordination diagram (using GAM model).
- `p.adjust.envfit` - custom-built function (author: D. Zelený) to adjust the *P*-values in the object created by the function `envfit`, using `p.adjust` function. Definition is [here](#).

<sup>1)</sup>

Note that the option to test the significance of supplementary variables passively projected onto ordination diagram is not available in CANOCO 5, where it would have to be done manually. CANOCO 5 alternative is to check the *t*-values reported together with results of regression coefficients - if absolute value of these *t*-values exceeds 2.1, one can consider them as significant (in case that number of samples minus number of supplementary variables is higher than 18) - see the CANOCO 5 manual ([ter Braak & Šmilauer 2012](#)), page 226.

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