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Drivers of a global spectrum of wetland traits: climate, habitats and plant adaptation strategy

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Wetland plants live in habitats which are distinguished from terrestrial ecosystems by their unique characteristics including anoxic conditions, frequent flooding and submergence. To understand how/why they deviate from terrestrial plants, a comprehensive quantitative knowledge of trait selection in wetlands is needed. We built a global database of wetland plant functional traits which includes >8000 observations of >1200 species from >200 references (containing both published and unpublished sources), encompassing leaf economics traits, eco-physiological adaptation traits and also associated environmental data from a variety of wetland habitats around the world. Our database is unique in aiming only at plants living in wetland habitats, and it has not been included in the TRY database yet.

Based on our database, we analysed the principal driving factors for wetland adaptation traits. We showed that different drivers affect adaptation traits differently. This suggests that seemingly similar wetland stresses (anoxia, flooding) across a variety of wetland habitats still select for a distinct set of wetland adaptation traits. We also noticed that some of the wetland adaptation traits were statistically decoupled from leaf economics spectrum (LES) traits, which suggests that wetland adaptation traits may not be constrained by the habitat resources/nutrient limitation. This allows wetland plants to survive in complex wetland ecosystems under varied hydrological regimes and fertility status. We also found trade-offs between some of the adaptation traits and LES traits, which suggests that plants need to optimize the allocation of resources between survival and growth for certain environmental stresses. The fact that no clear leading dimension was detected for wetland adaption traits emphasizes the complex character of wetland ecosystems.

Our database will provide the backbone for quantitatively understanding the wetland plant species' adaptation strategy, distribution and their link to ecosystem functioning such as the carbon and nitrogen cycles for future studies at a global scale.