Hydraulics constrain the scaling of the leaf economics spectrum

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Two main foci in ecology are to understand trade-offs explaining ecological strategies and to identify the critical traits of species responsible for them. A universal leaf economics spectrum (LES) has been described, spanning from conservative leaves with long life-span and slow returns on C and nutrients to acquisitive leaves with short life-span and fast returns on investment. The functional significance of this spectrum for plants remains to be completely elucidated. Here we compile trait data from ~1650 species worldwide to show that xylem water transport properties constrain the scaling of LES. We found evidence of coordination of LES with hydraulic efficiency and safety at the tissue level but also compensatory responses in terms of allocation and minimum water potentials, resulting in LES being largely decoupled from whole-plant water economics. Our results indicate that water economics need to be included to improve our capacity to scale up from the leaf to the plant in predicting vegetation changes under new climatic conditions.