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Hydraulic constraints and stomatal optimization

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The classical Cowan-Farquhar approach to identifying optimal stomatal conductance treats total water loss as an imposed constraint. That approach can conflict, both physically and economically, with biophysical constraints on water transport. In this talk, I will illustrate these conflicts and discuss alternative approaches -- recently pioneered by Sperry, Wolf, Eller, and their colleagues -- that aim to penalize excessive transpiration by explicitly incorporating hydraulic risk, using hydraulic vulnerability curves (VCs). In this context, I will present preliminary efforts to determine whether VCs accurately reflect the actual probabilistic risk posed by low water potentials (that is, the expected reduction in total carbon gain), as well as an extension to the recent analytical solution by Eller et al.