

# Exploring the genetic basis of the root economics spectrum

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By analyzing the acquisition-conservation tradeoff in root systems among different plants, ecologists have put forward the root economics spectrum (RES) hypothesis. Some plant species have finer and cost-effective absorptive roots that contribute to rapid nutrient uptake but have shorter lifespans, whereas others have thicker and less cost-effective absorptive roots marked by slower nutrient acquisition but longer lifespans. The RES hypothesis reflects the correlations among different root traits, which can facilitate the adaptation of plants to the local environment. The RES is one of the core issues in root ecology, but its adaptive role and genetic basis remains largely elusive.

Recently, Prof. Weile Chen from the Zhejiang University College of Life Sciences teamed up with Prof. Thomas Juenger from the University of Texas at Austin in exploring the molecular basis of the RES from the perspective of functional genetics. These research findings appeared in a research article entitled "The genetic basis of the root economics spectrum in a perennial grass" in the journal *PNAS* on November 19, 2021.

Using a genetic mapping population of the native perennial [switchgrass](#), their study confirms the multiple genetic linkages among root morphology, growth, and turnover. Switching alleles derived from lowland ecotypes to those derived from upland ecotypes reduces the cost of root construction, but it increases the turnover of absorptive roots. The genetic trade-off between construction cost and turnover is likely to facilitate the local adaptation of root strategy along the warm to cold climatic gradients of the species range.

In addition, the aboveground biomass of switchgrass is perceived as an alternative to fossil fuel, and its belowground [root](#) system helps store carbon captured by leaf photosynthesis in the soil.

"This study finds no direct conflict in genetic regulation between

increasing aboveground yields and enhancing belowground carbon sequestration in switchgrass," said Chen, adding that it suggests the enormous potential of switchgrass for achieving a win-win situation in "emission reduction" and "carbon sequestration."

**More information:** Weile Chen et al, The genetic basis of the root economics spectrum in a perennial grass, *Proceedings of the National Academy of Sciences* (2021). [DOI: 10.1073/pnas.2107541118](https://doi.org/10.1073/pnas.2107541118)

Provided by Zhejiang University

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