



UCLouvain

# GRANAR: a R package to better understand the functional importance of root anatomy



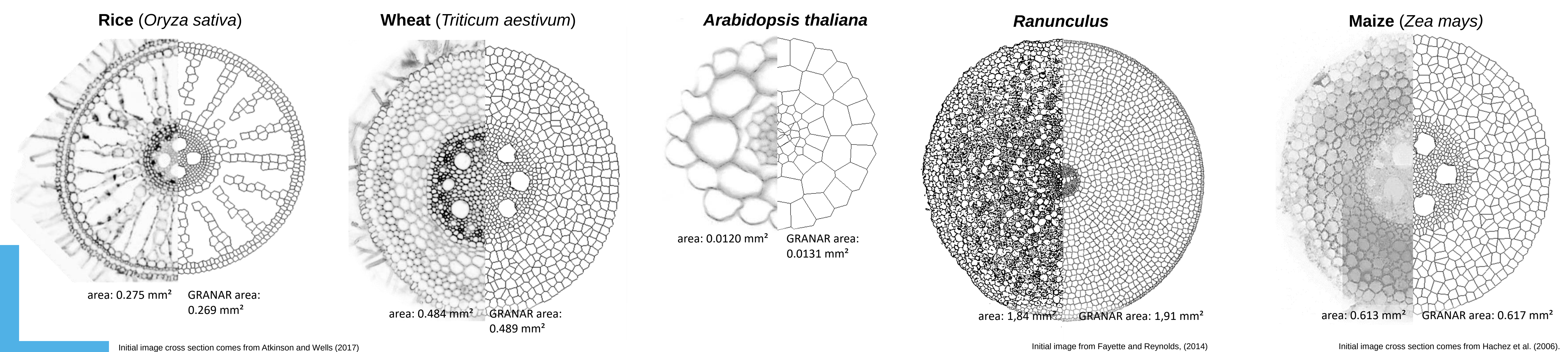
A. Heymans<sup>1</sup>, V. Couvreur<sup>1</sup>, T. Larue<sup>2</sup>, A. Paez-Garcia<sup>3</sup>, and G. Lobet<sup>1,4</sup>

1. Earth and Life Institute, UCL, Belgium 2. Stanford University, USA 3. Noble Research Institute, Ardmore, USA 4. Agrosphere IBG3, FZJ, Germany  
Contact: [adrien.heyman@uclouvain.be](mailto:adrien.heyman@uclouvain.be)

**Context:** Root hydraulic conductivity is a limiting factor along the water pathways between the soil and the leaf, and root radial conductivity is itself defined by cell-scale hydraulic properties and anatomical features. However, quantifying the influence of anatomical features on the radial conductivity remains challenging due to complex time-consuming experimental procedures. This experimental restriction creates a knowledge gap in the quantitative assessment of individual component of the anatomy.

**Goal:** We want to better understand the functional properties of root anatomy.

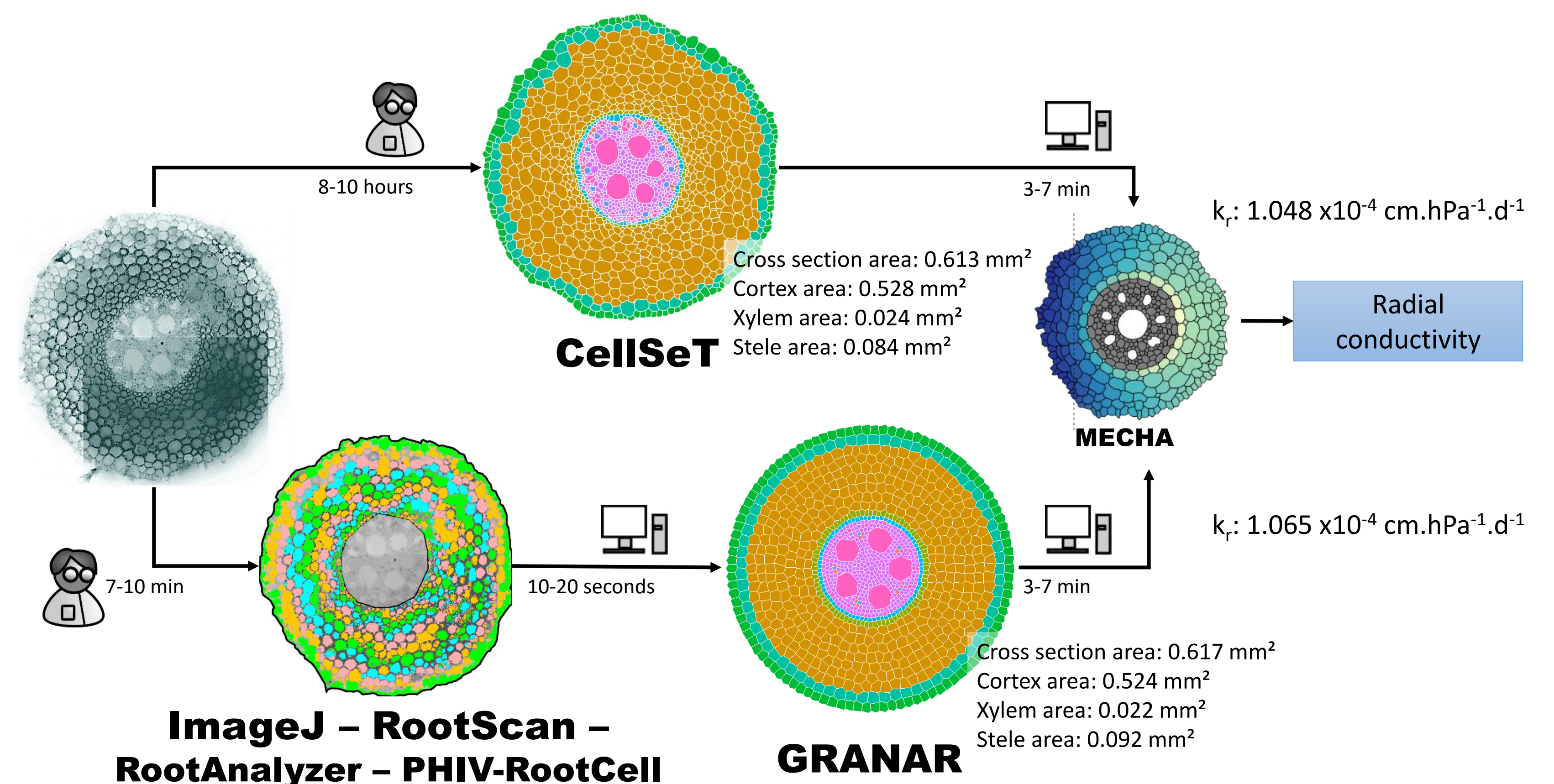
**Therefore:** We developed a computational tool, the Generator of Root ANATomy in R (GRANAR) that can be used to rapidly generate digital versions of contrasted monocotyledon root anatomical networks.



**GRANAR** uses a limited set of root anatomical parameters, easily acquired with existing image analysis tools such as **ImageJ**. The generated anatomical network can then be used in combination with hydraulic models to estimate the corresponding hydraulic properties. Here, we estimate the corresponding hydraulic radial conductivities with the hydraulic model **MECHA** (Model of Explicit Cross-section Hydraulic Architecture). We used GRANAR to re-analyse large maize (*Zea mays*) anatomical datasets from the literature.

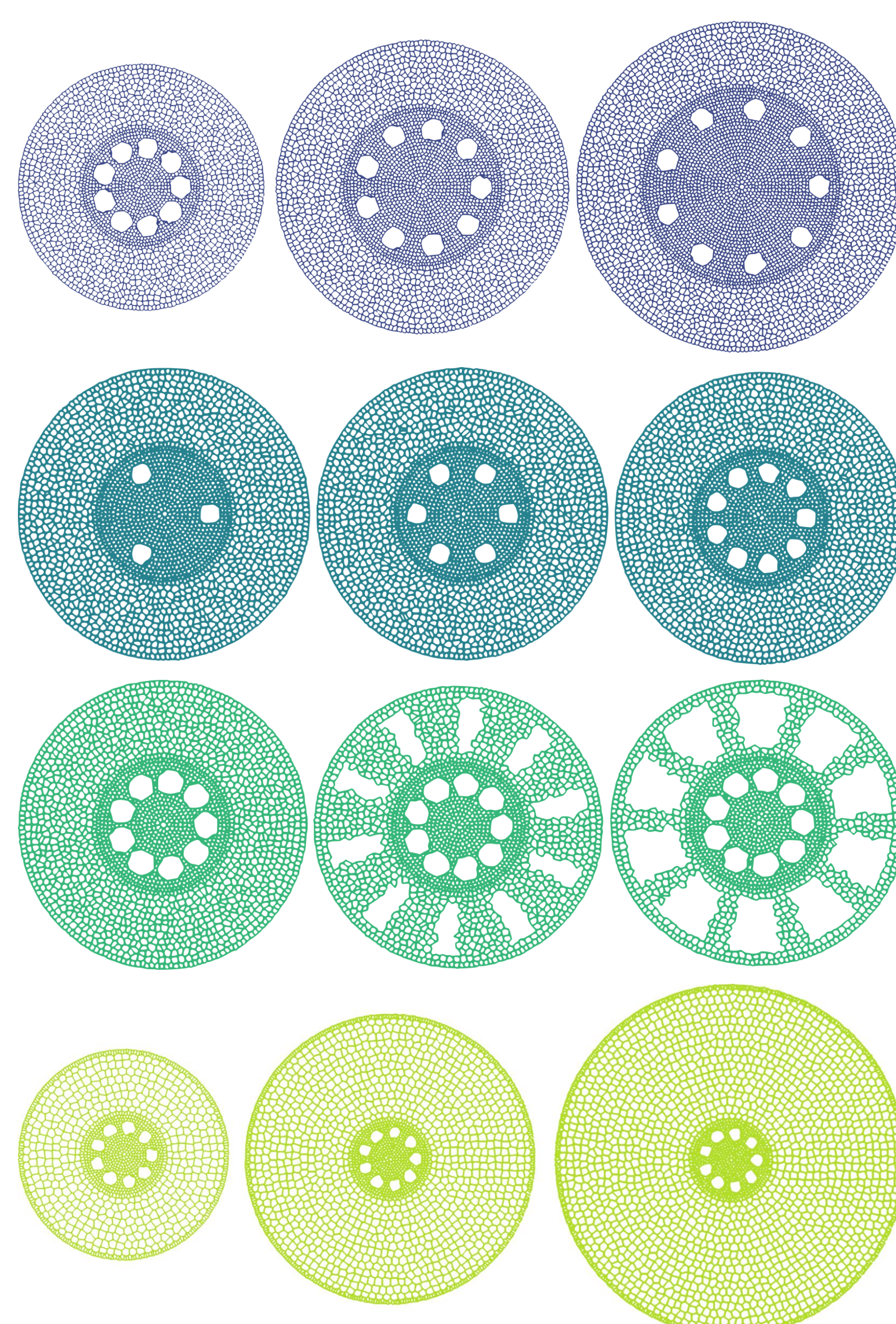
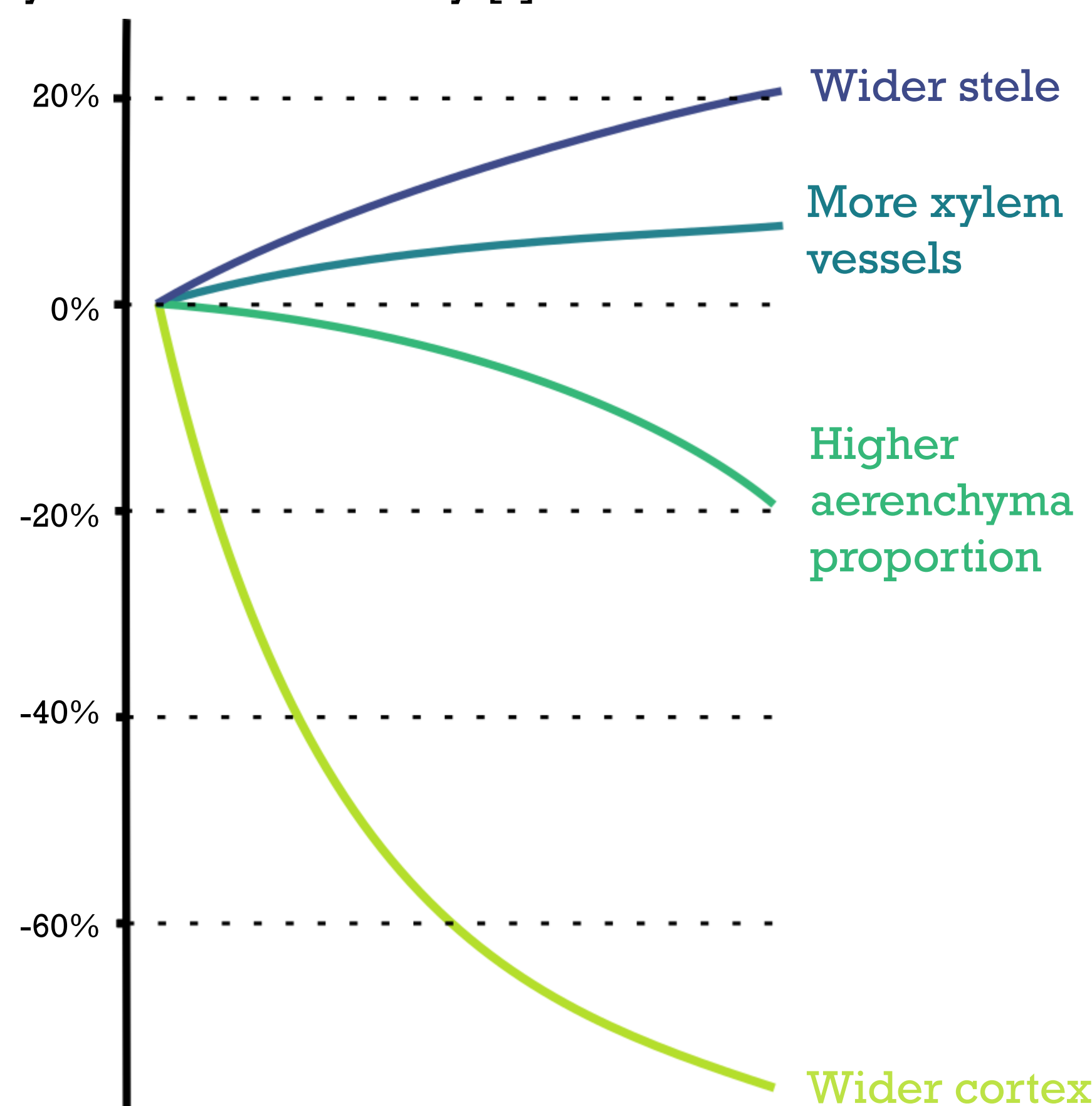
Our simulations highlight the large importance of the width of the stele and the cortex for the hydraulic radial conductivities.

## A shortcut to estimation of hydraulic properties

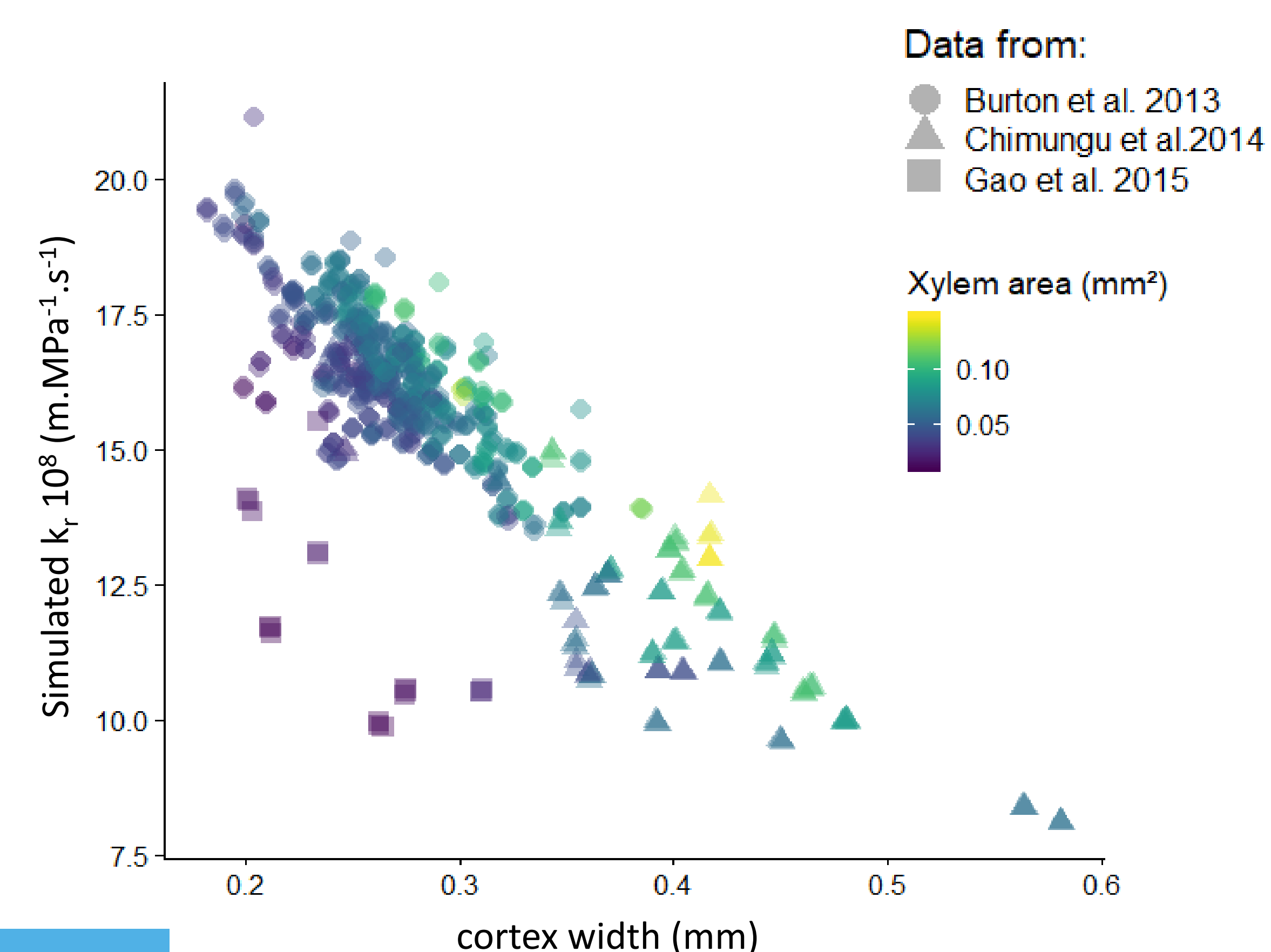


## Evaluation of the individual effect of anatomical features

Relative change of radial hydraulic conductivity [-]



## Meta-analysis of large dataset



[granar.github.io](https://github.com/granar)

