

# LINKING FORESTS AND LANDSCAPES IN FOUR DIMENSIONS

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## Topography and forest structure



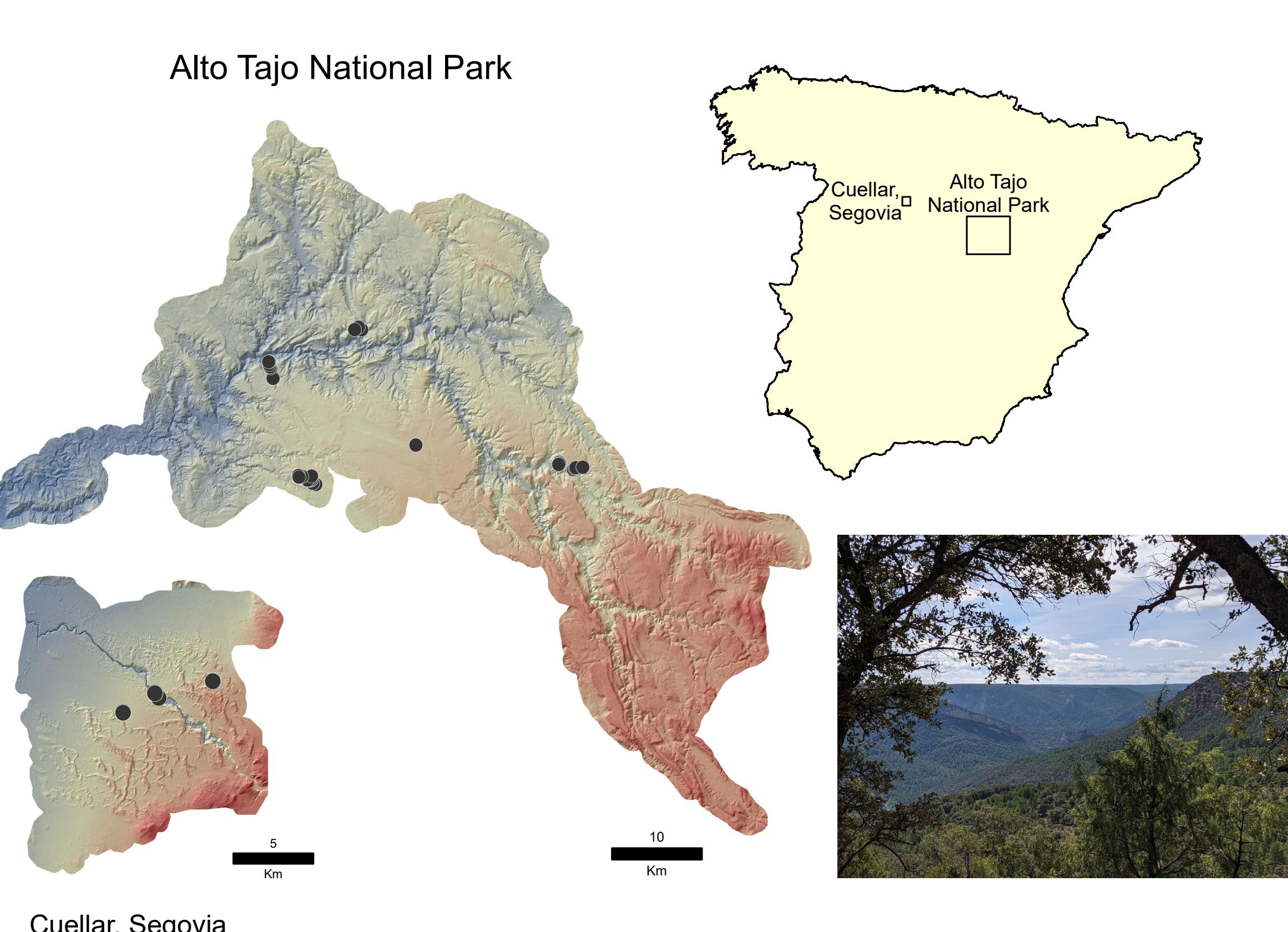
Forests and landscapes are interconnected, with vegetation dynamics driving geomorphic process and landscape form influencing the structure and function of trees and forests.

Many previous studies considering these relationships use forest-scale metrics, and do not consider the influence of forest heterogeneity at an individual tree level.

Recent advances in Terrestrial Laser Scanning (TLS) now allow the precise identification and measurement of individual trees within forests.

## Does microtopography influence individual tree morphology?

## Study site

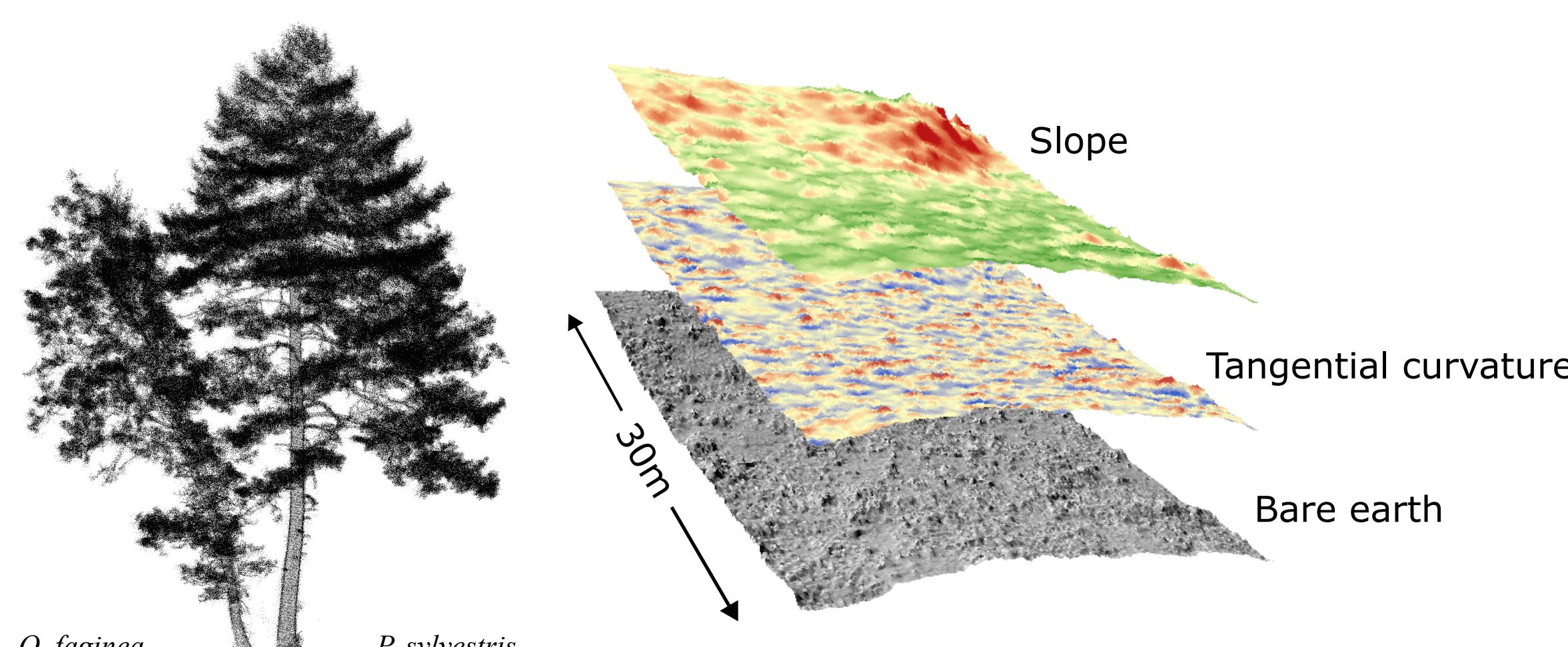


Across 34 forest plots in central Spain, a total of 2485 trees were scanned. Plots are dominated by pine and oak forest, thin soils and a Mediterranean climate.

## Data analysis

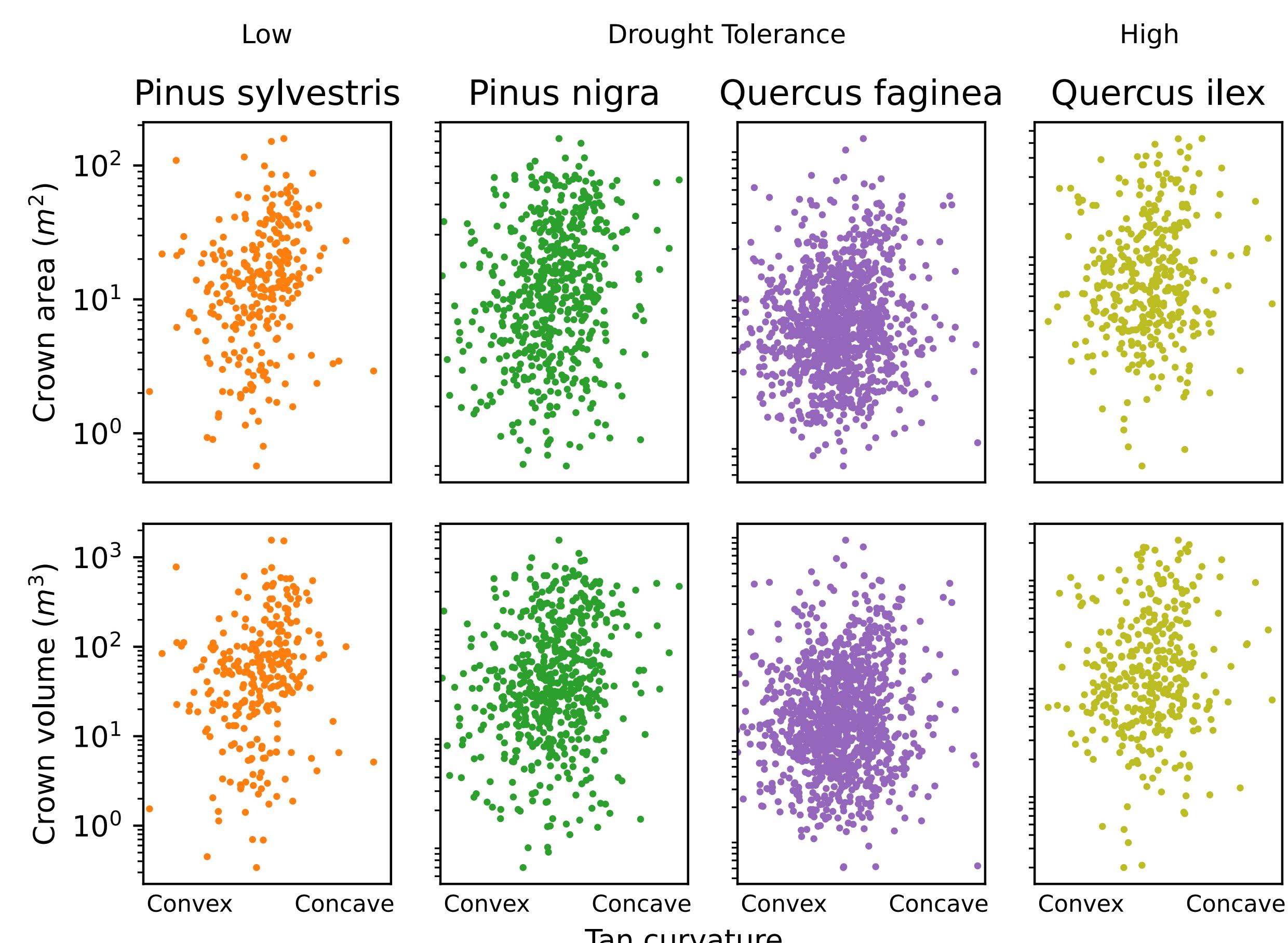
Individual tree pointclouds are processed to extract morphometric parameters in conjunction with repeat field measurements.

Ground pointclouds are interpolated to a 10 cm resolution grid using PDAL, and LSDTopoTools is used to compute topographic metrics.



## Crown properties

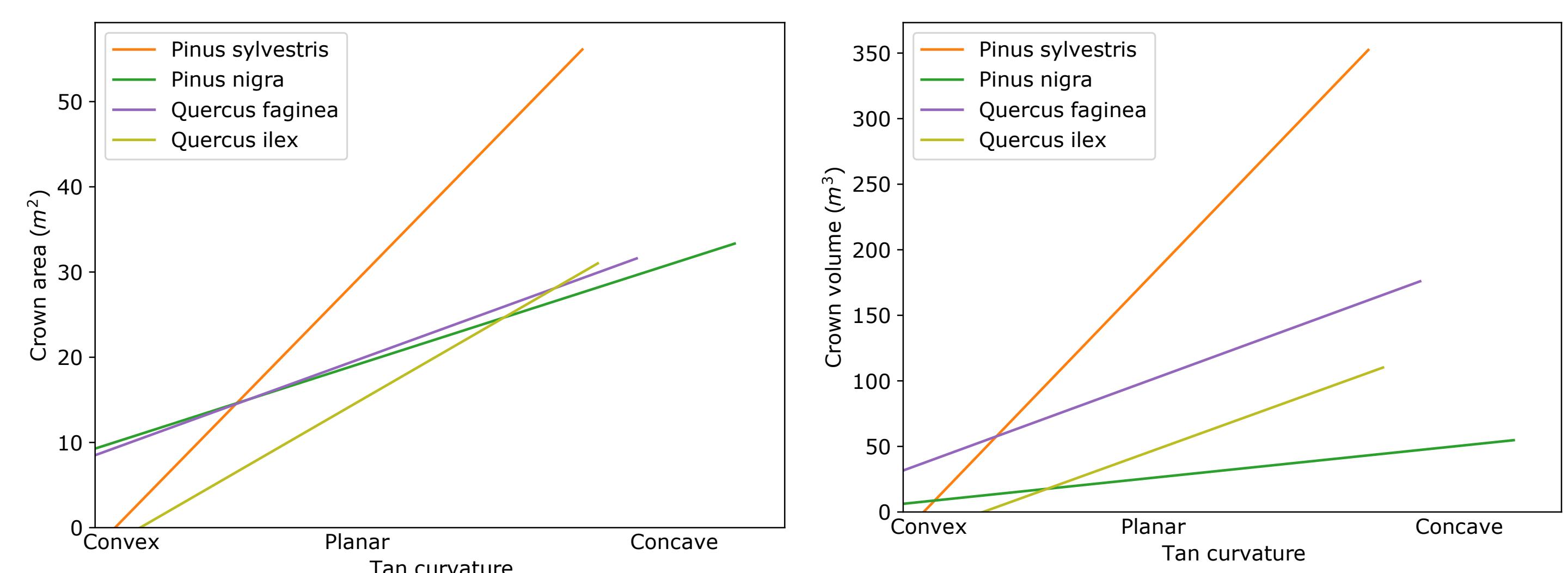
Individual crown morphology provides insight into tree health and competition dynamics. In water limited environments, topographic convergence may provide a buffer against drought stress, exerting a control on forest structure and dynamics.



## Mixed effect modelling

Fitting a mixed effect model allows us to understand if local tangential curvature is a control on individual canopy morphology:

$$\text{CrownMorphology} \sim \text{TreeHeight} + \text{TanCurvature} + \epsilon_{pl} \quad (1)$$



Canopy properties are more correlated with topographic convergence in drought intolerant species.

## Summary

- Individual tree morphology is related to microtopography.
- The scale of microtopographic control is related to tree species functional traits.
- Connecting long term forest surveys to topography can drive new insights into the coevolution of life and landscapes.

## Acknowledgements

E.R.L., S.W.D.G. and H.J.F.O. were funded by a UKRI Future Leaders Fellowship awarded to E.R.L. [MR/T019832/1]. S.W.D.G. was supported by the UCU fighting fund. This research utilised Queen Mary's Apocrita HPC facility, supported by QMUL Research-IT.