Topography shapes the diversity, structure and carbon content of tropical forest landscapes

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CSIRO, Ecosystem Change Ecology

GFBI – FECS joint symposium

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Meet the team

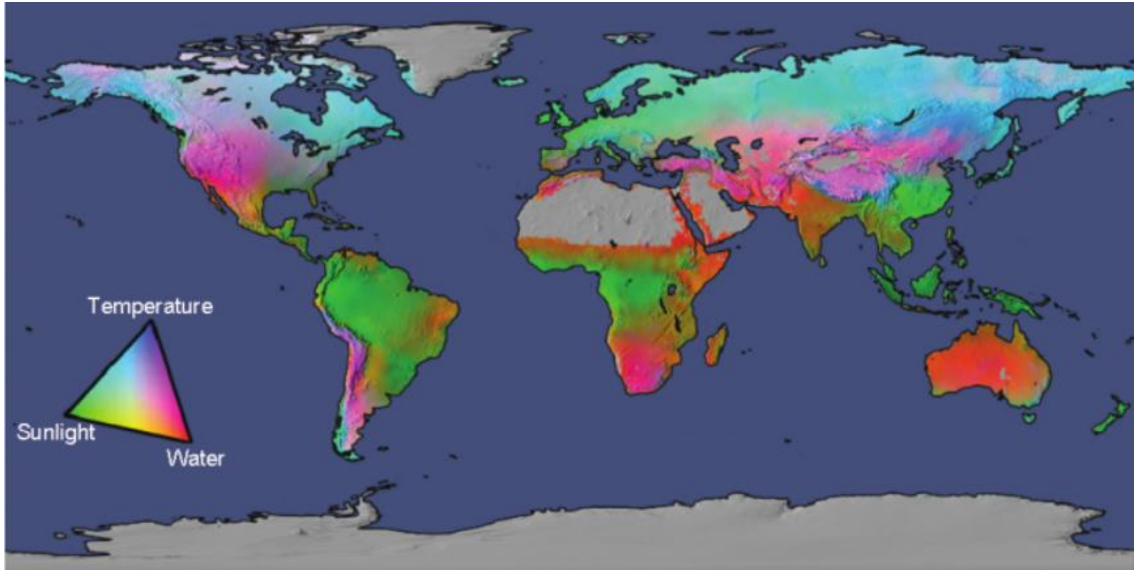
David Coomes

Michele Dalponte

David Burslem

What controls the structure, composition & function of tropical forests?

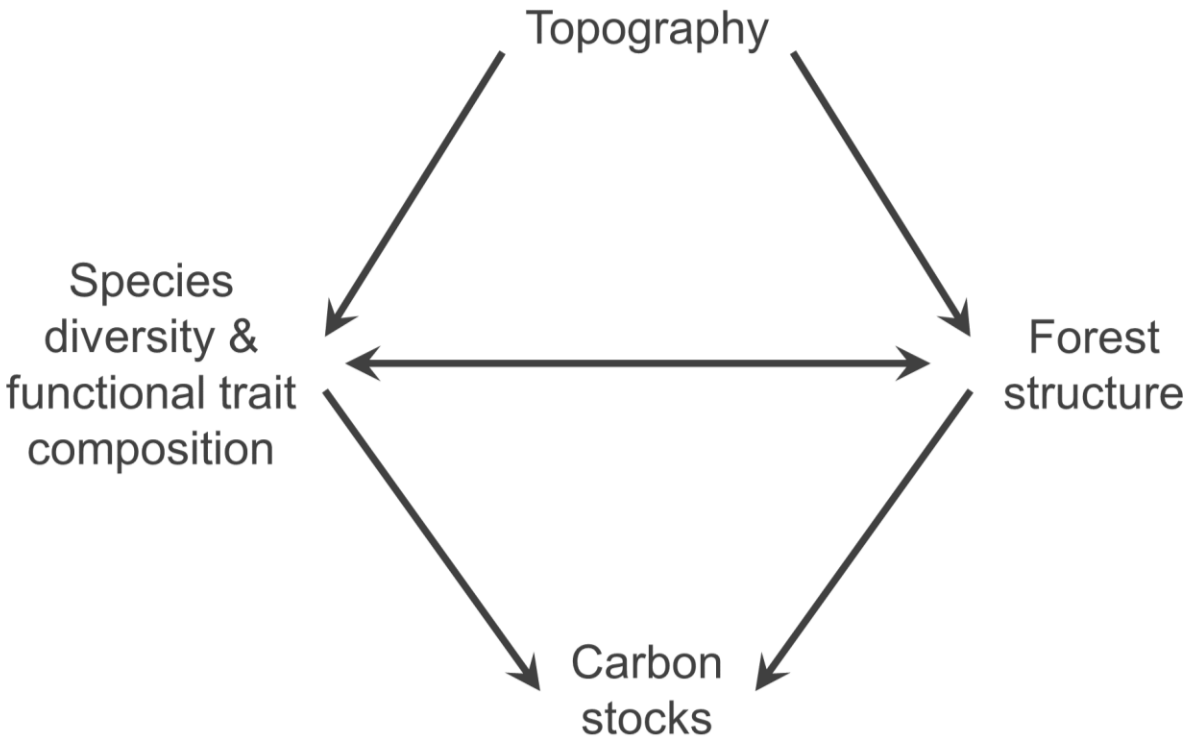
Macro-scale drivers of structure, composition & function



Boisevenue & Running (2006) *GCB*

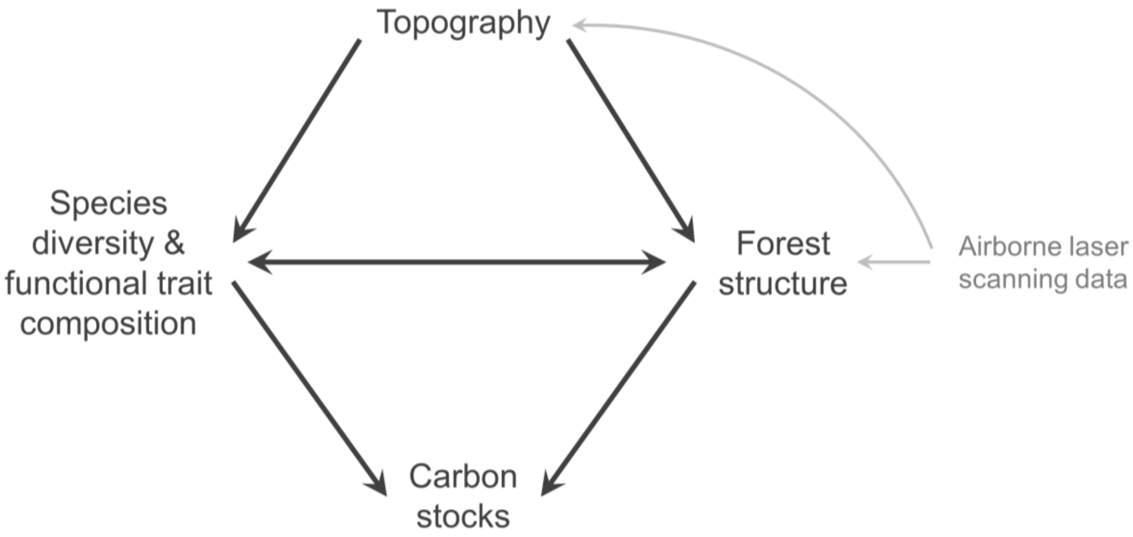
What about fine-scale heterogeneity in forest structure & function?

Topography, forest structure & function

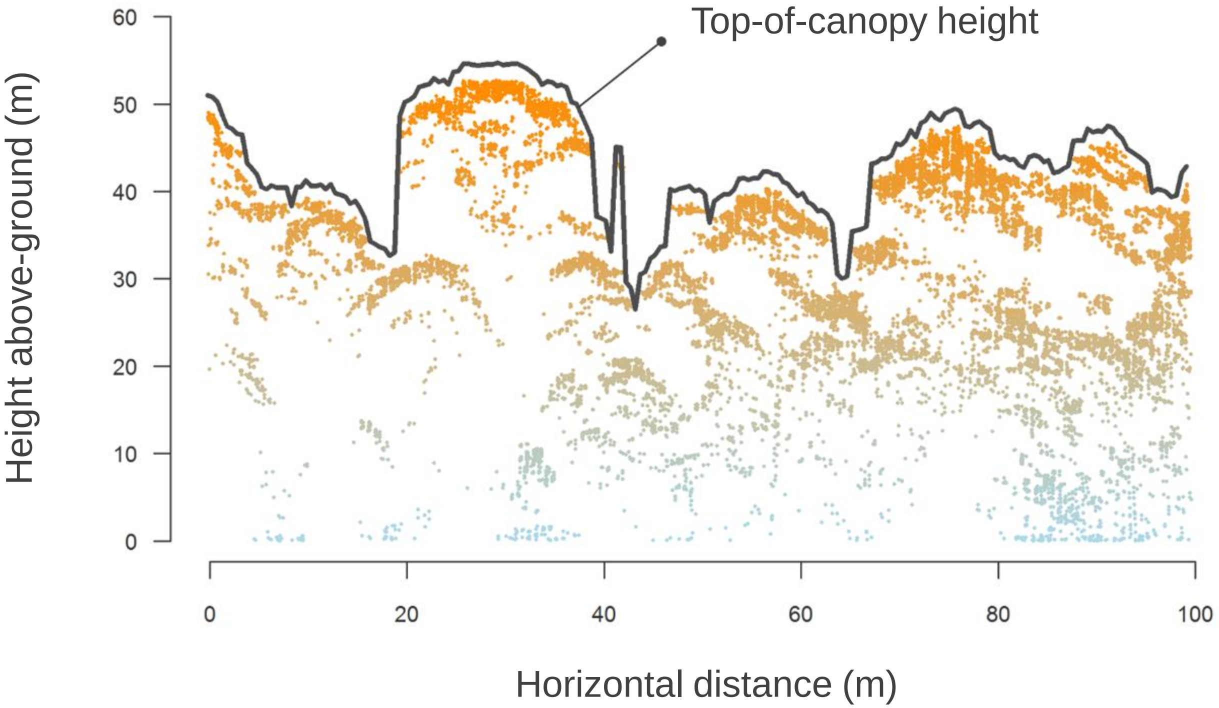


Source: Wikimedia Commons

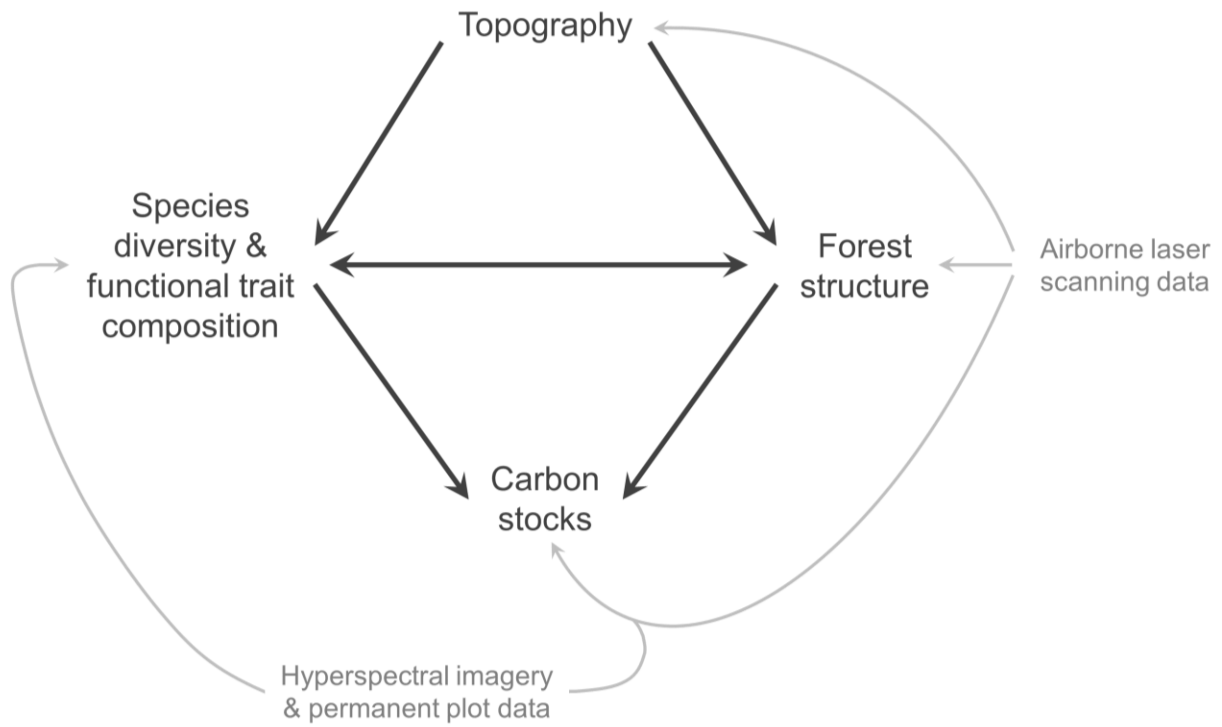
A bird’s eye view of forest ecosystems



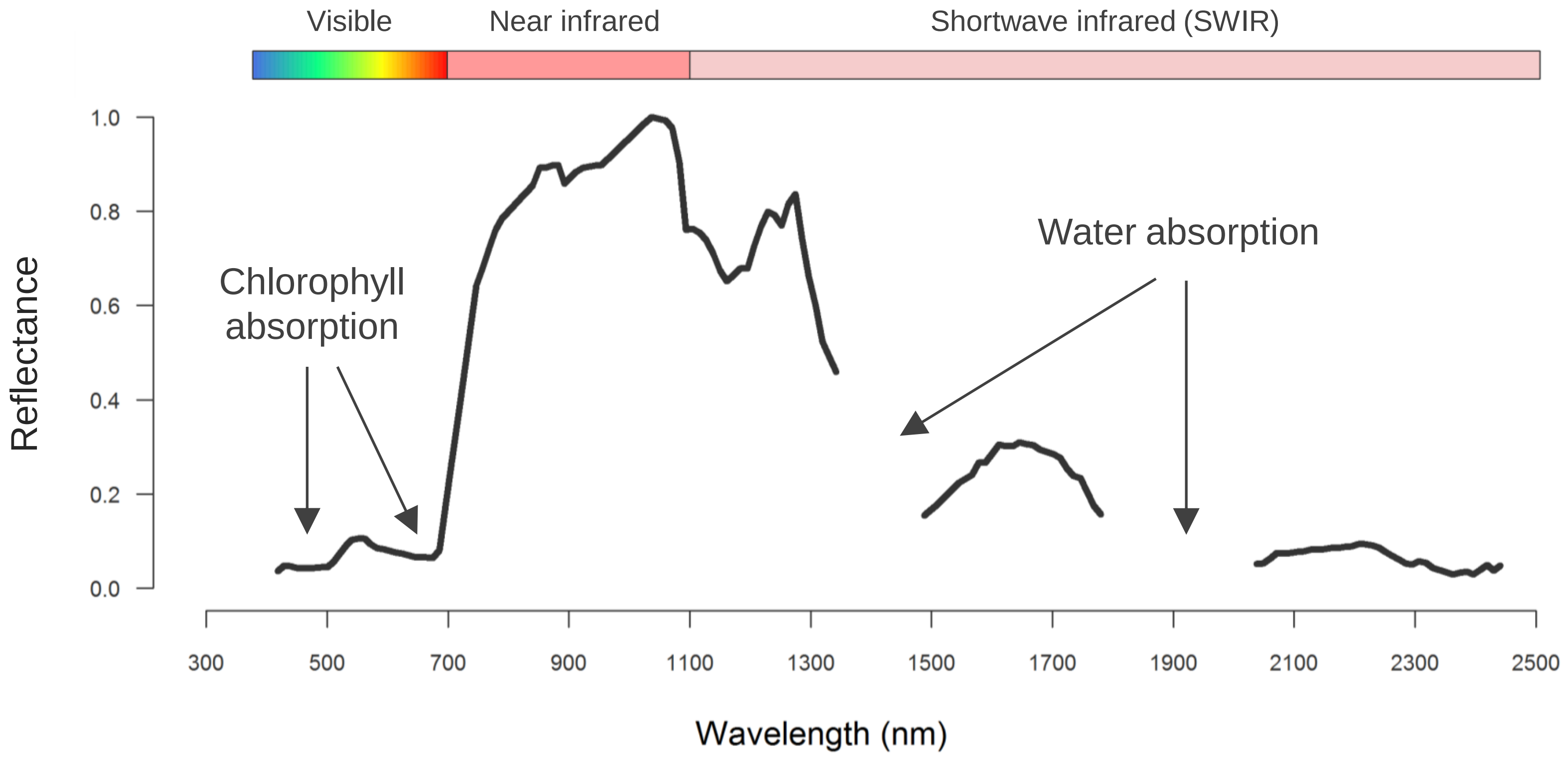
Airborne laser scanning (a.k.a. LiDAR)



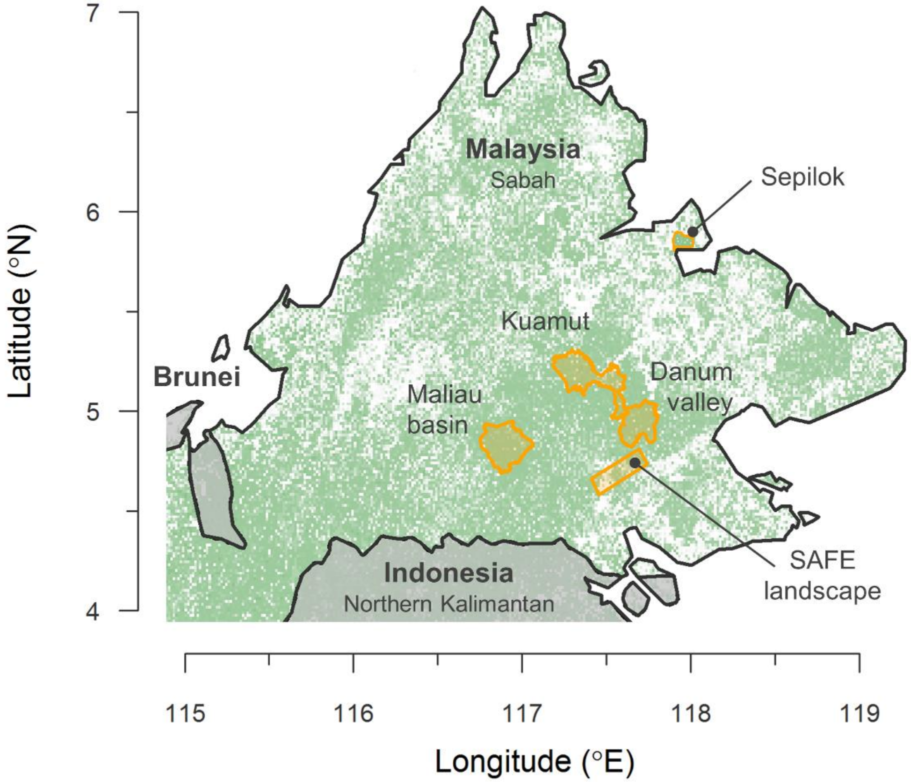
A bird’s eye view of forest ecosystems



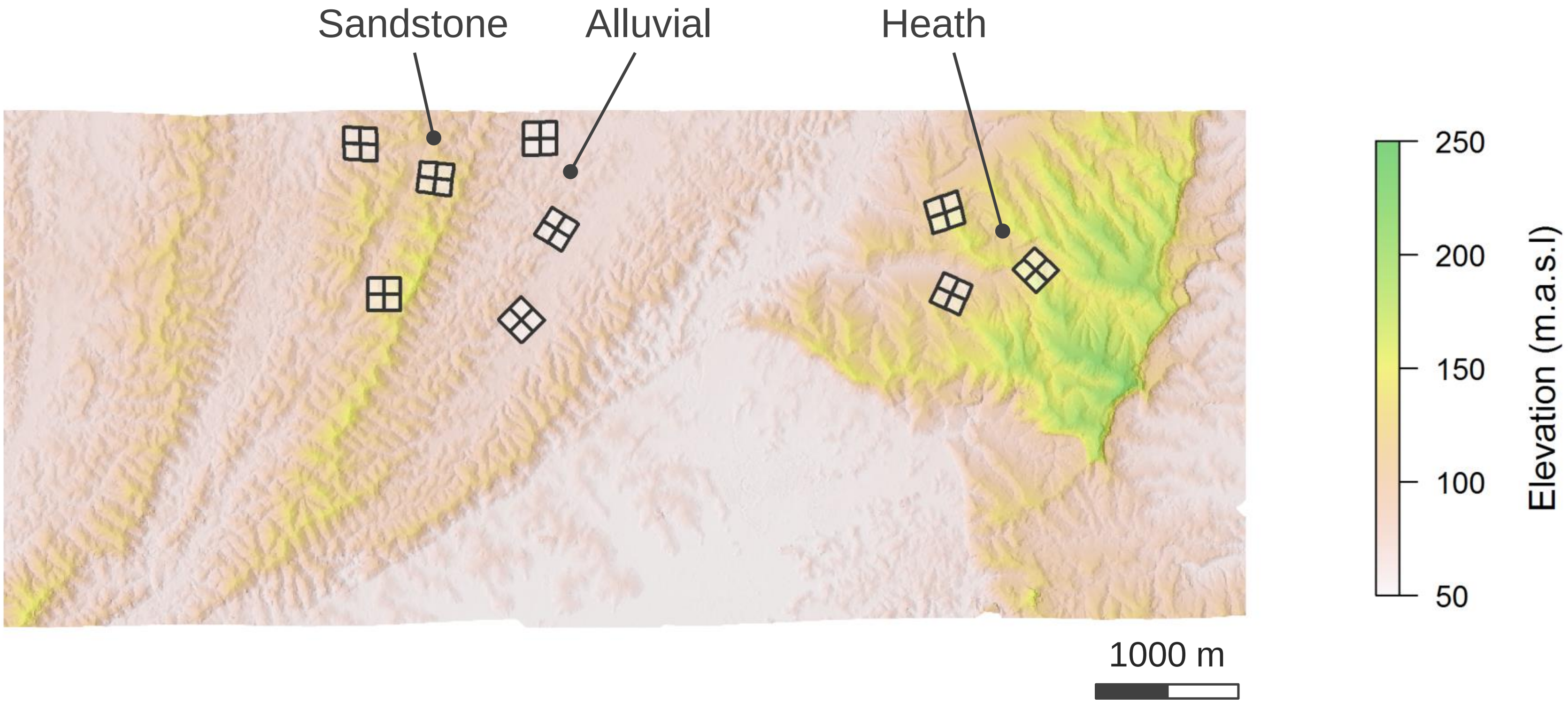
Hyperspectral imagery



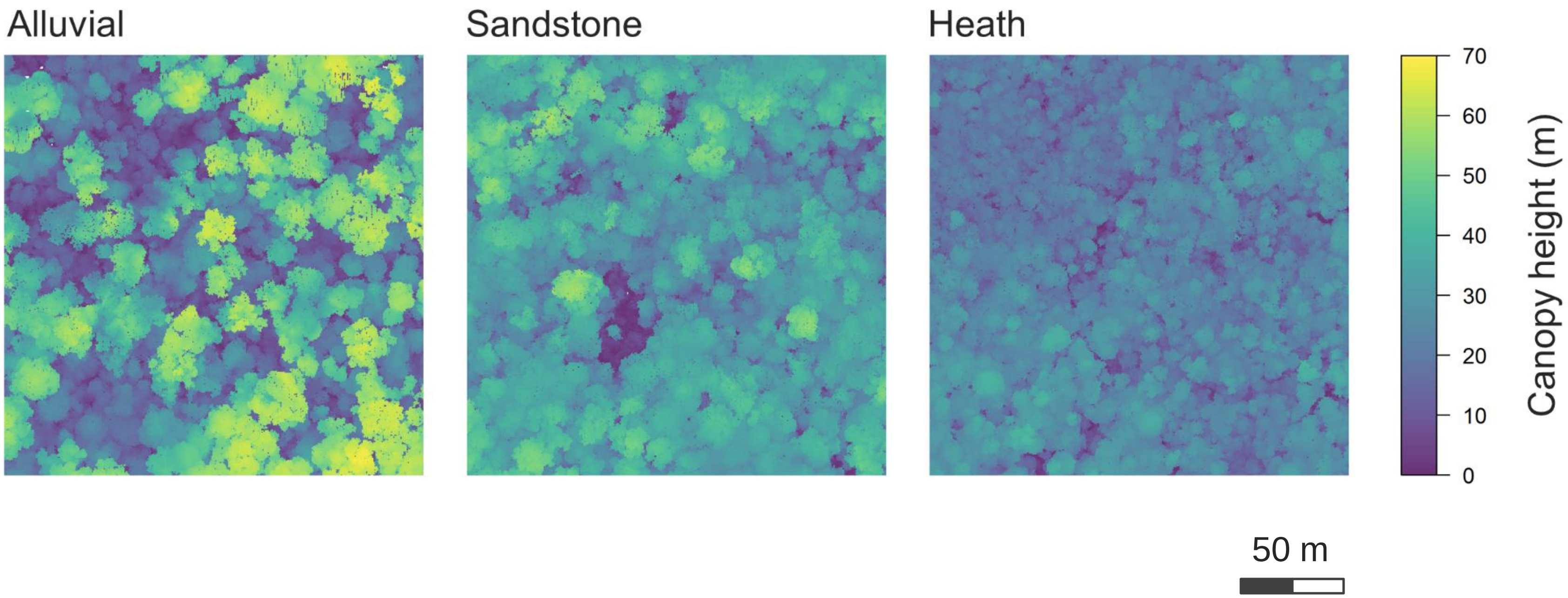
Sabah, Malaysian Borneo



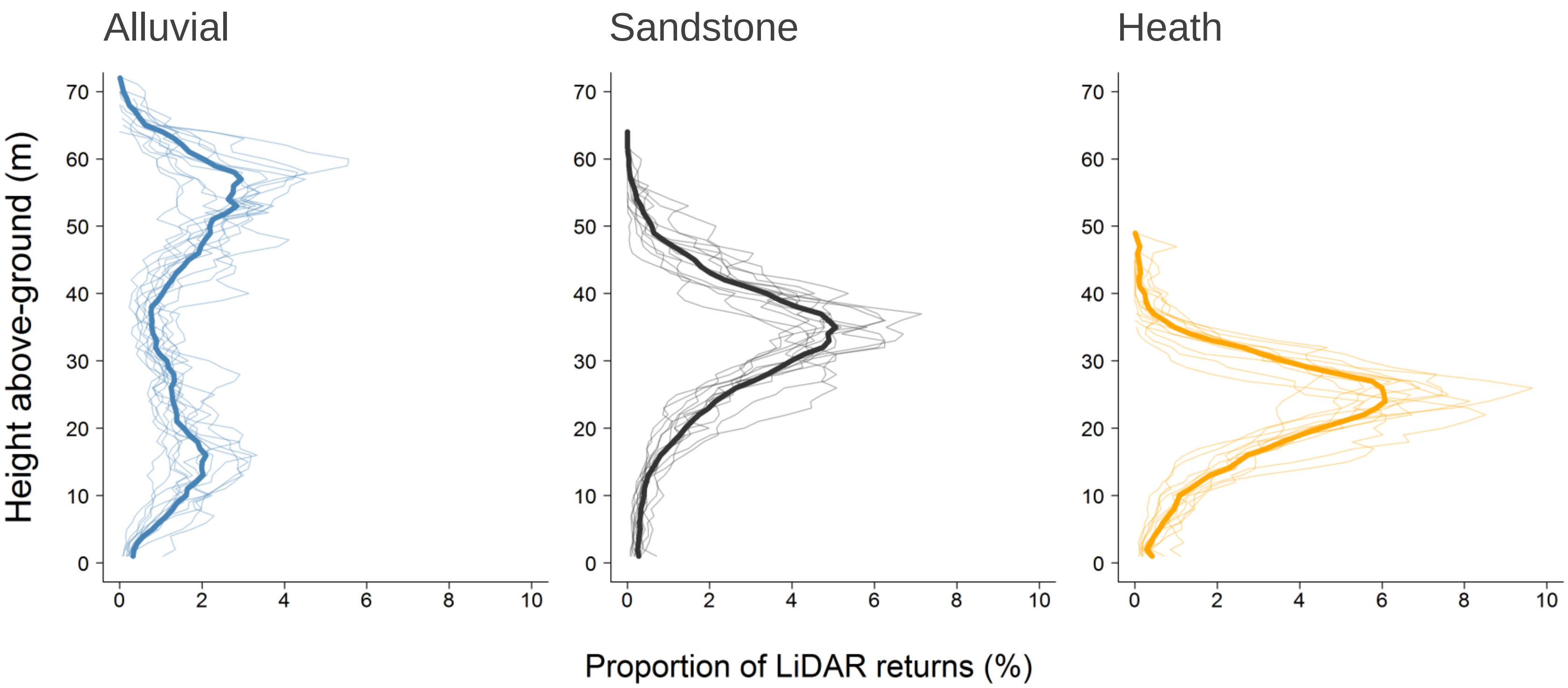
Sepilok Forest Reserve



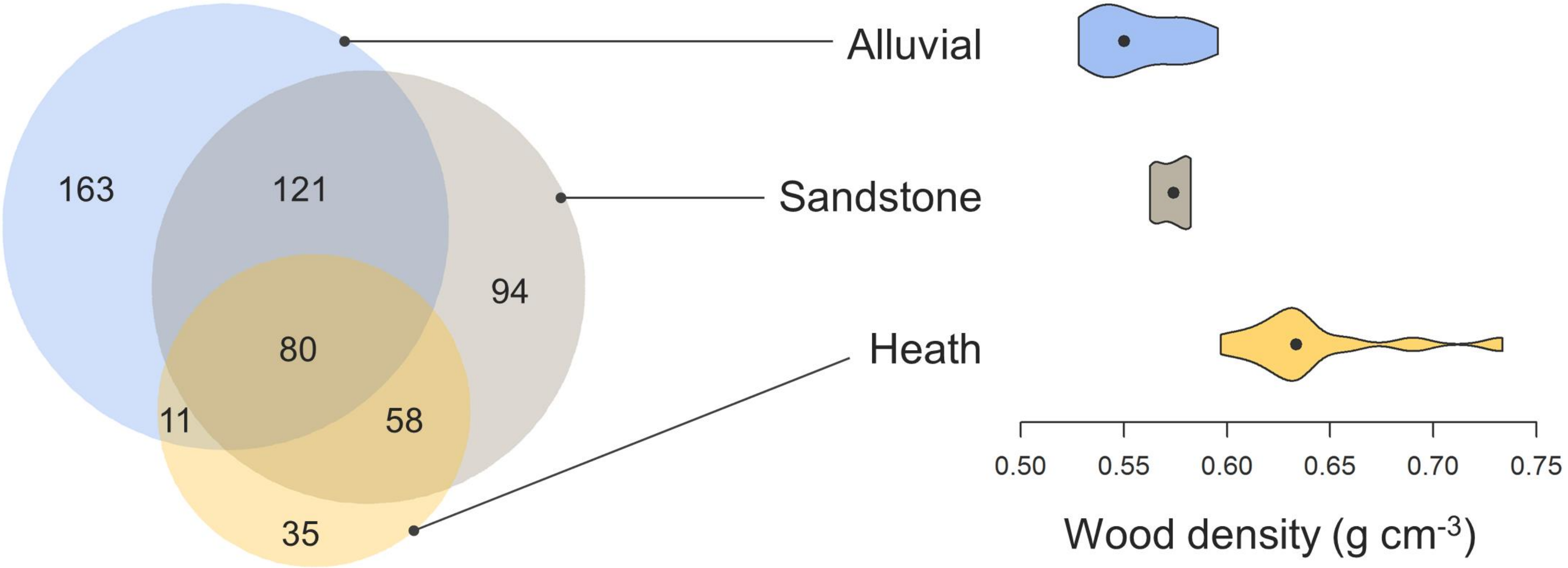
Variation in forest structure



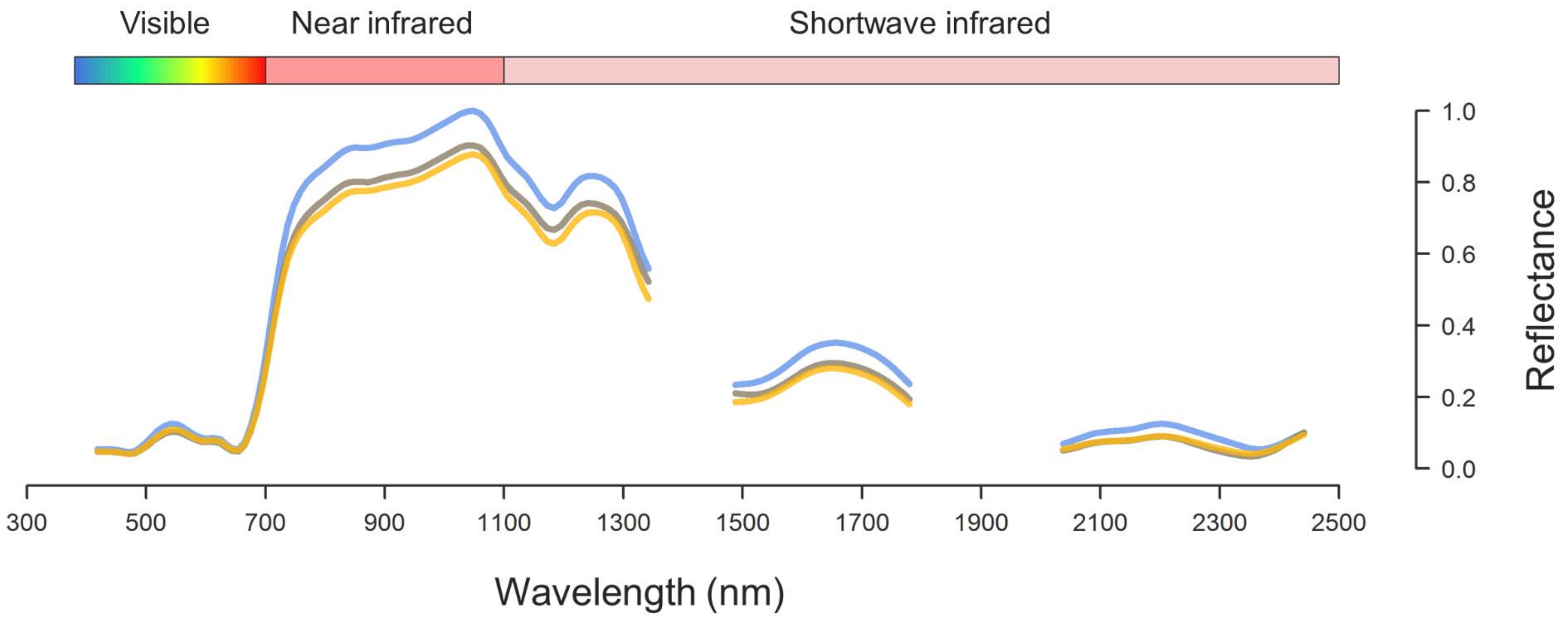
Variation in forest structure



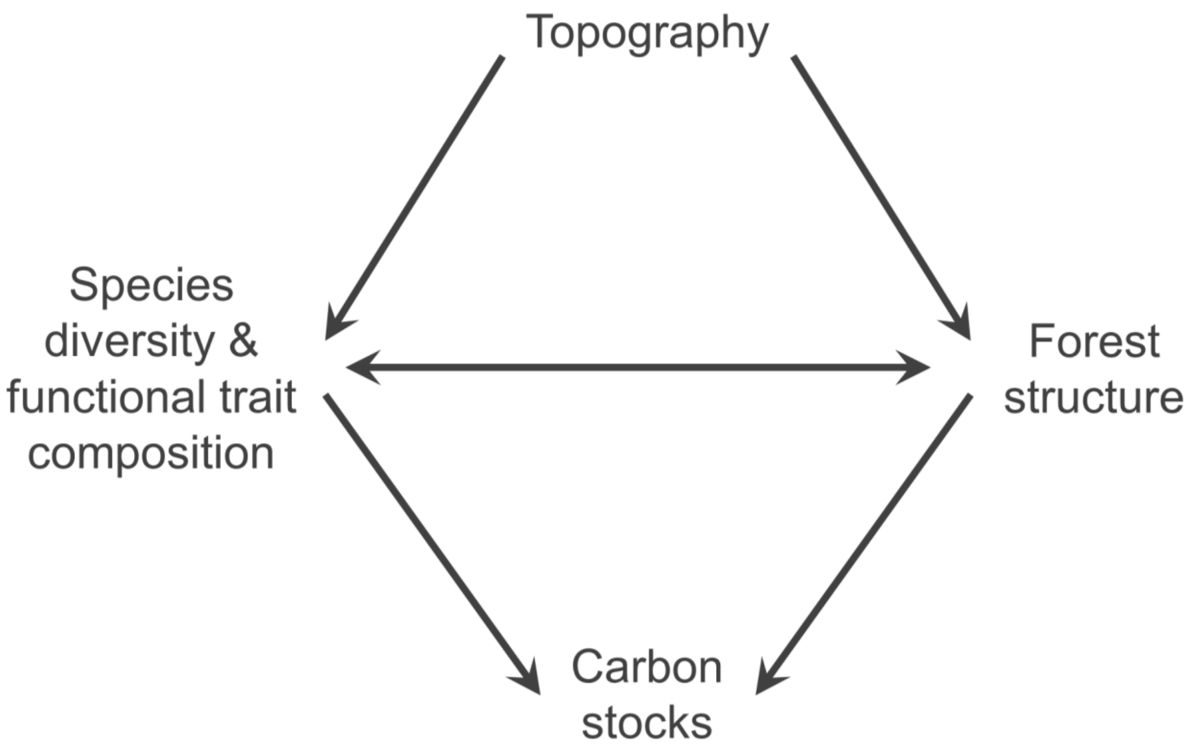
Variation in species composition, diversity & functional make-up



Variation in species composition, diversity & functional makeup



Testing the model



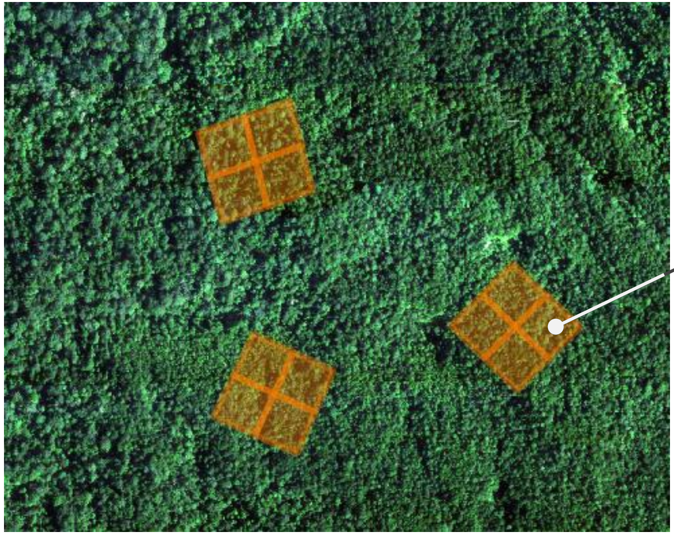
Testing the model

i. Develop plot-level models relating field estimates of **species richness**, **wood density** and **aboveground carbon stocks** to remotely-sensed attributes

ii. Use local models to up-scale forest attributes from plot to **landscape level**

iii. Fit structural equation models to identify direct and indirect **effects of topography** on forest structure, functional composition, diversity and carbon stocks

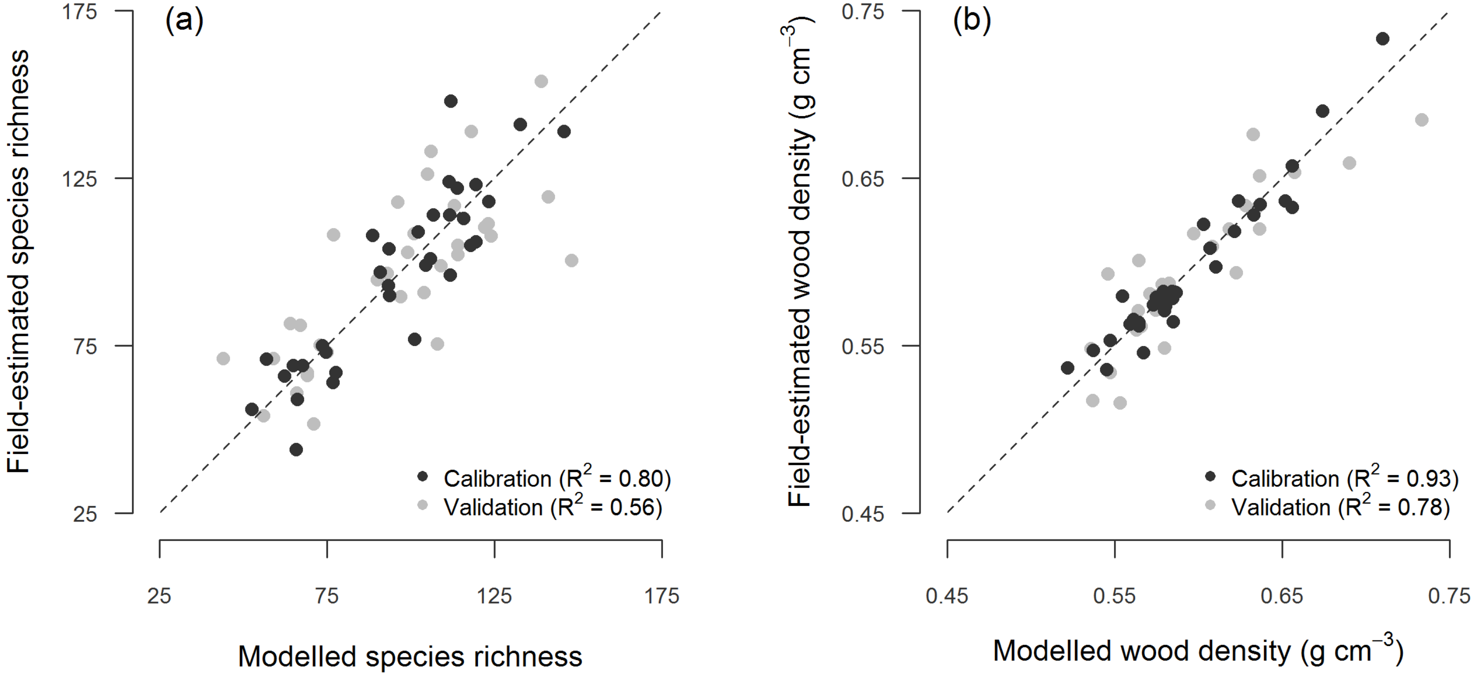
Up-scaling species diversity & wood density using hyperspectral imagery



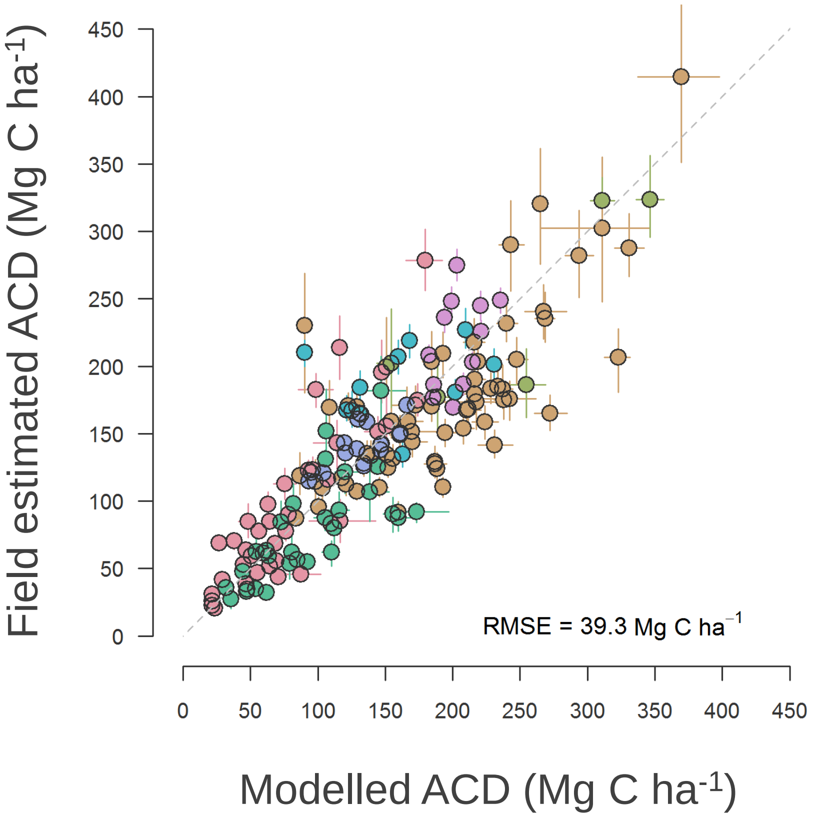
Species diversity ≈ within-plot variation

Wood density ≈ within-plot mean

Estimating tree species richness & wood density

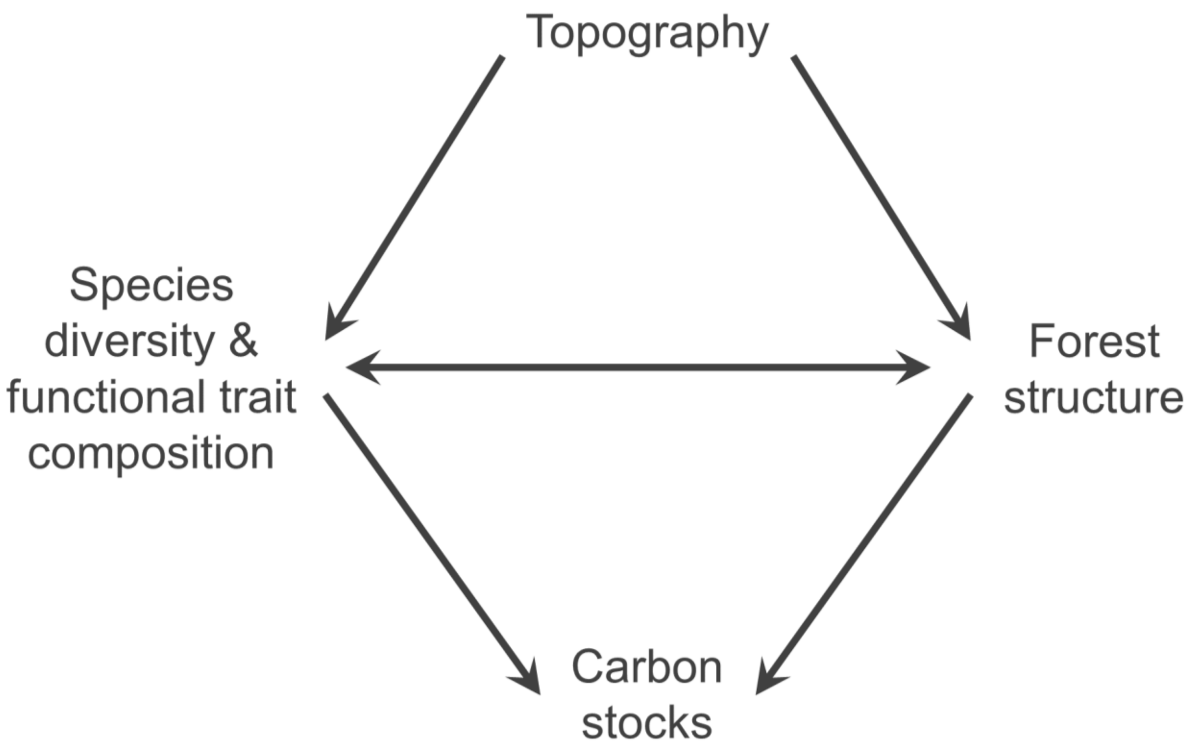


Estimating aboveground carbon density

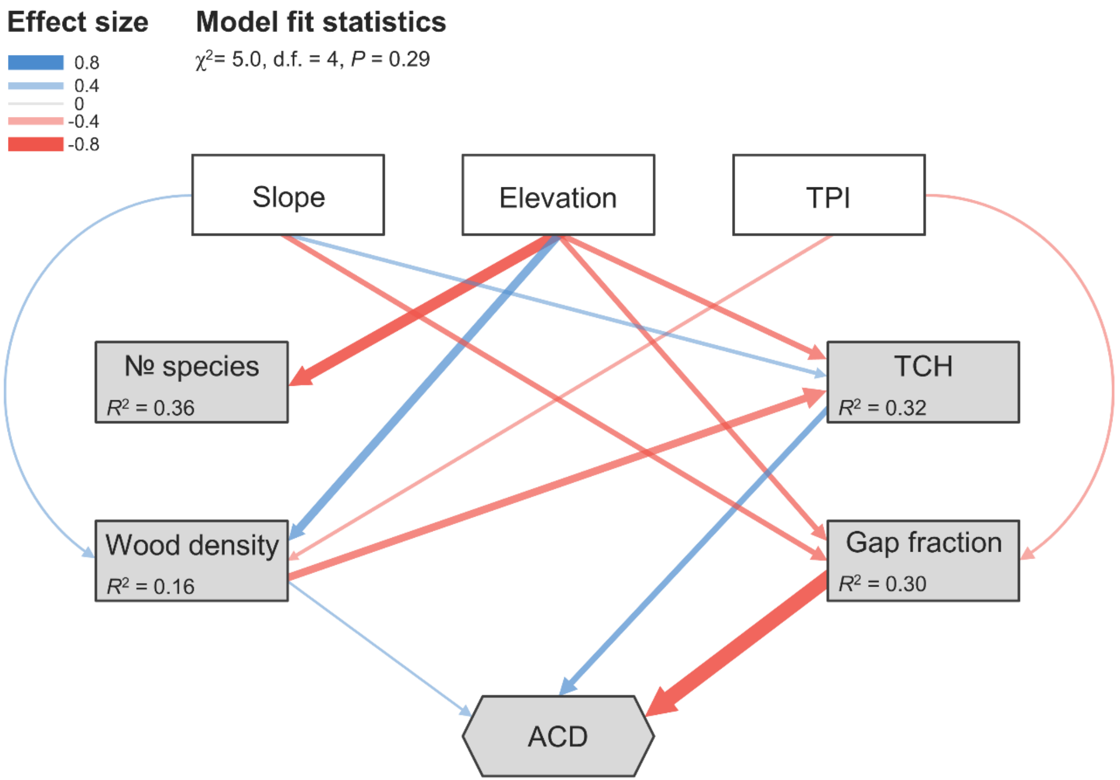


Jucker *et al*. (in review)

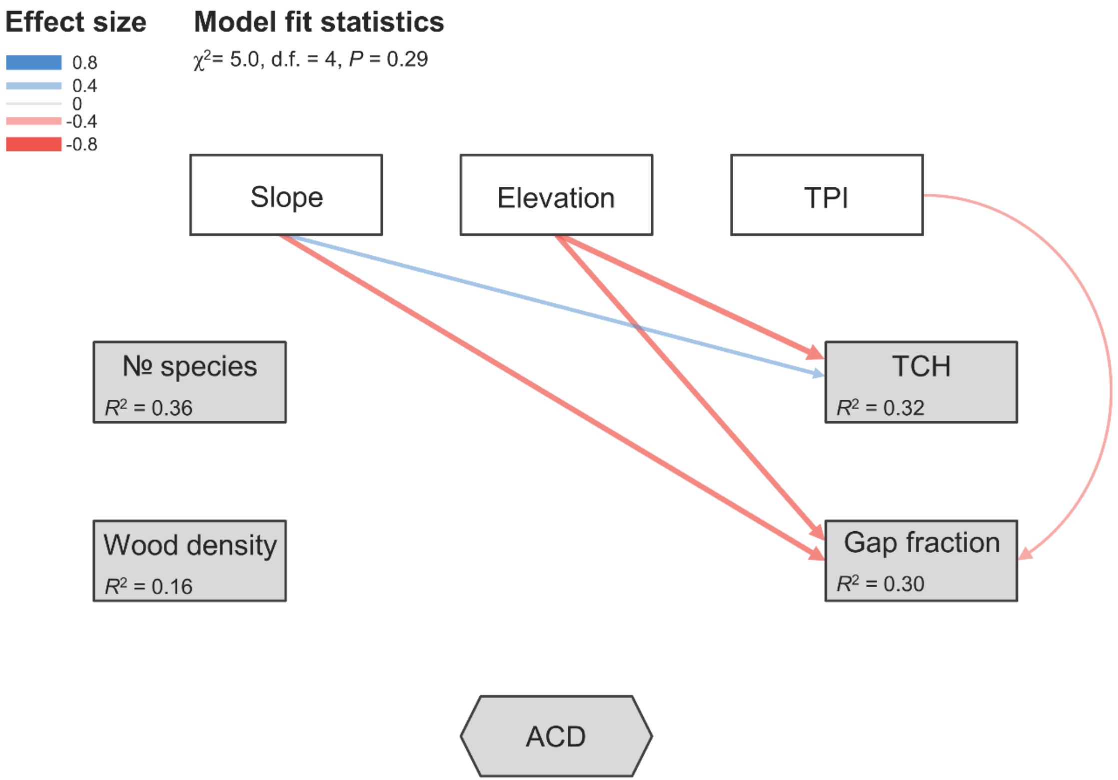
Testing the model



Testing the model



Topography & forest structure



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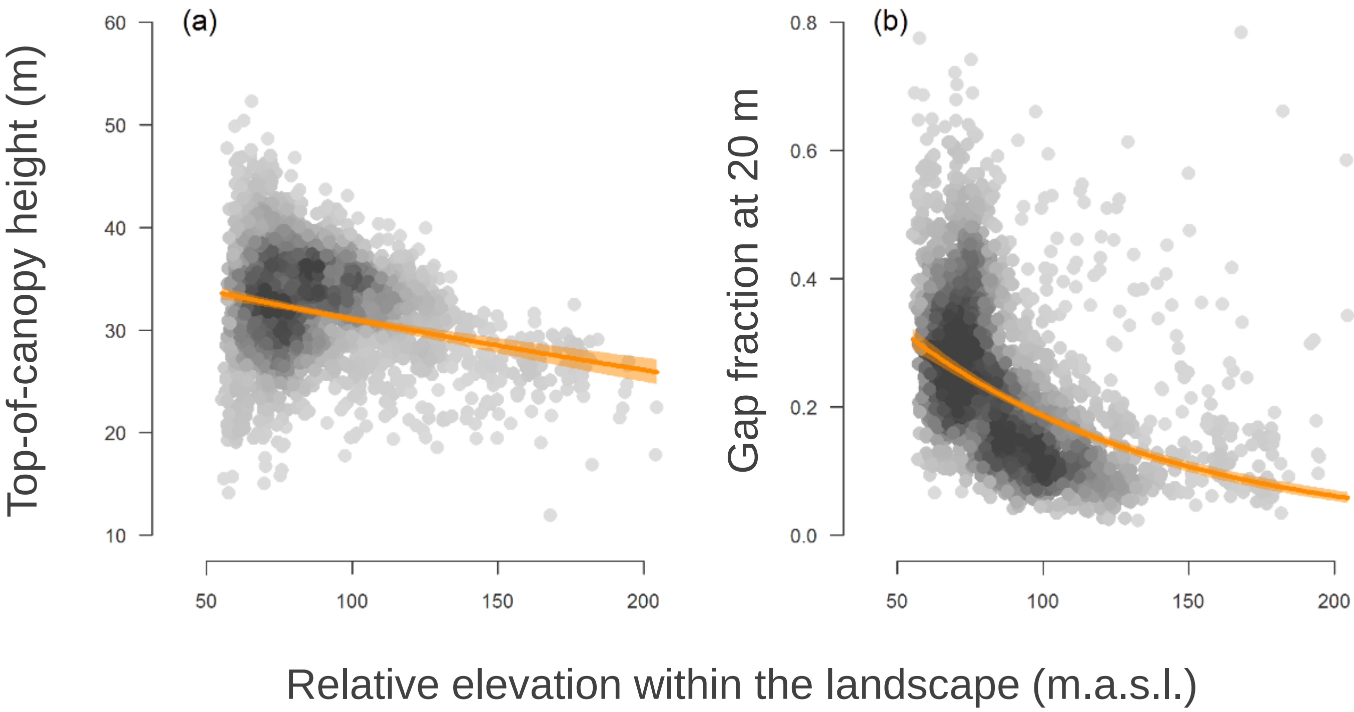
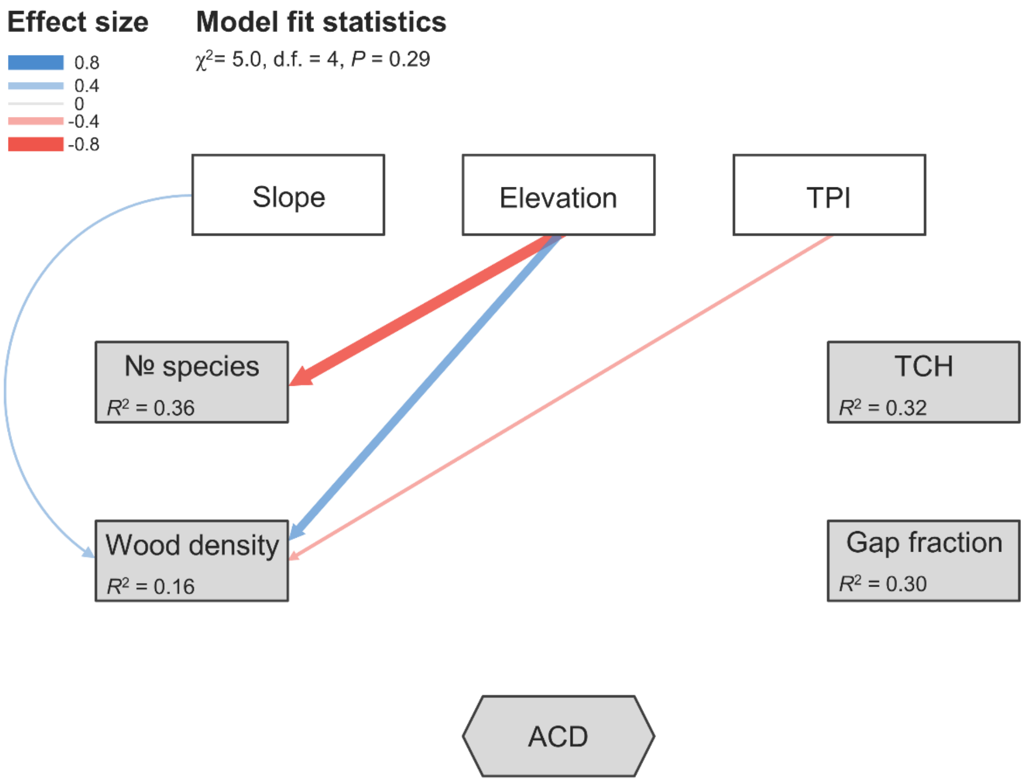


Topography, species diversity & traits



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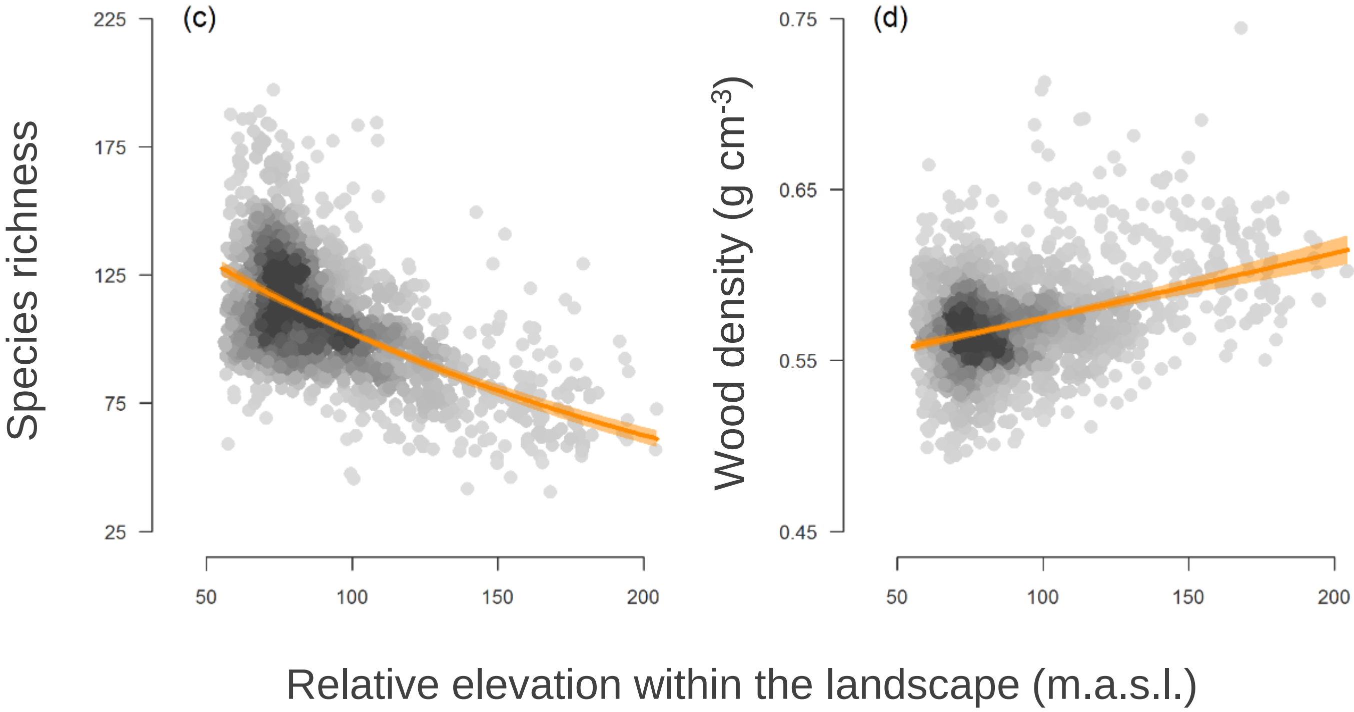
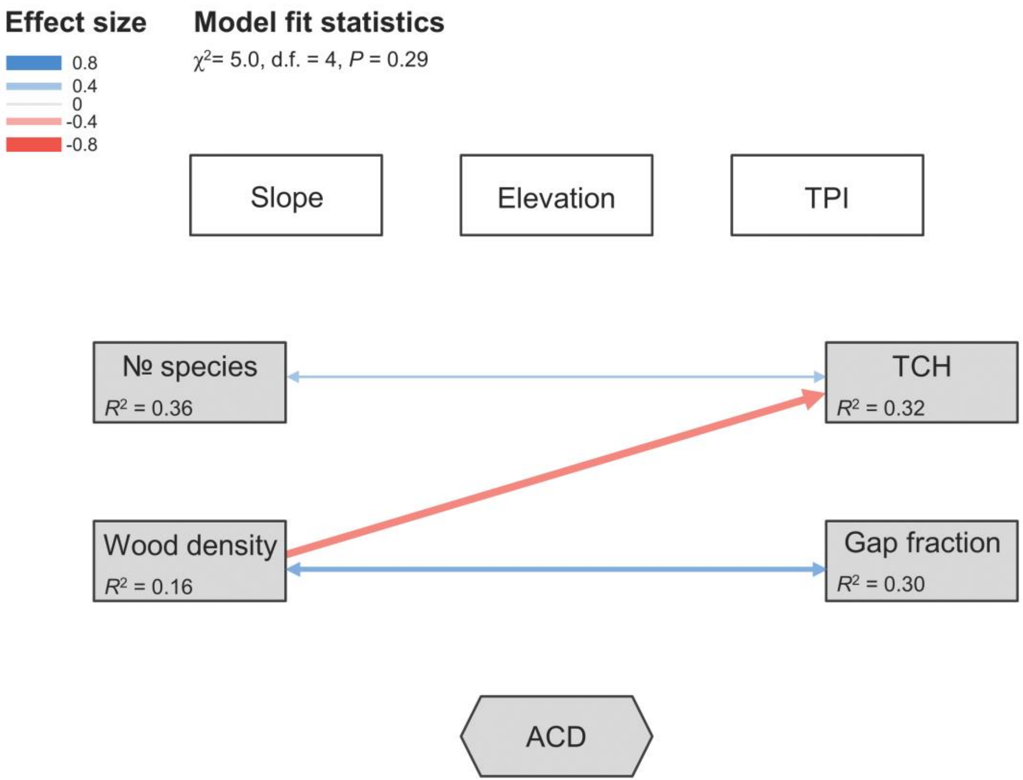


Forest structure & composition



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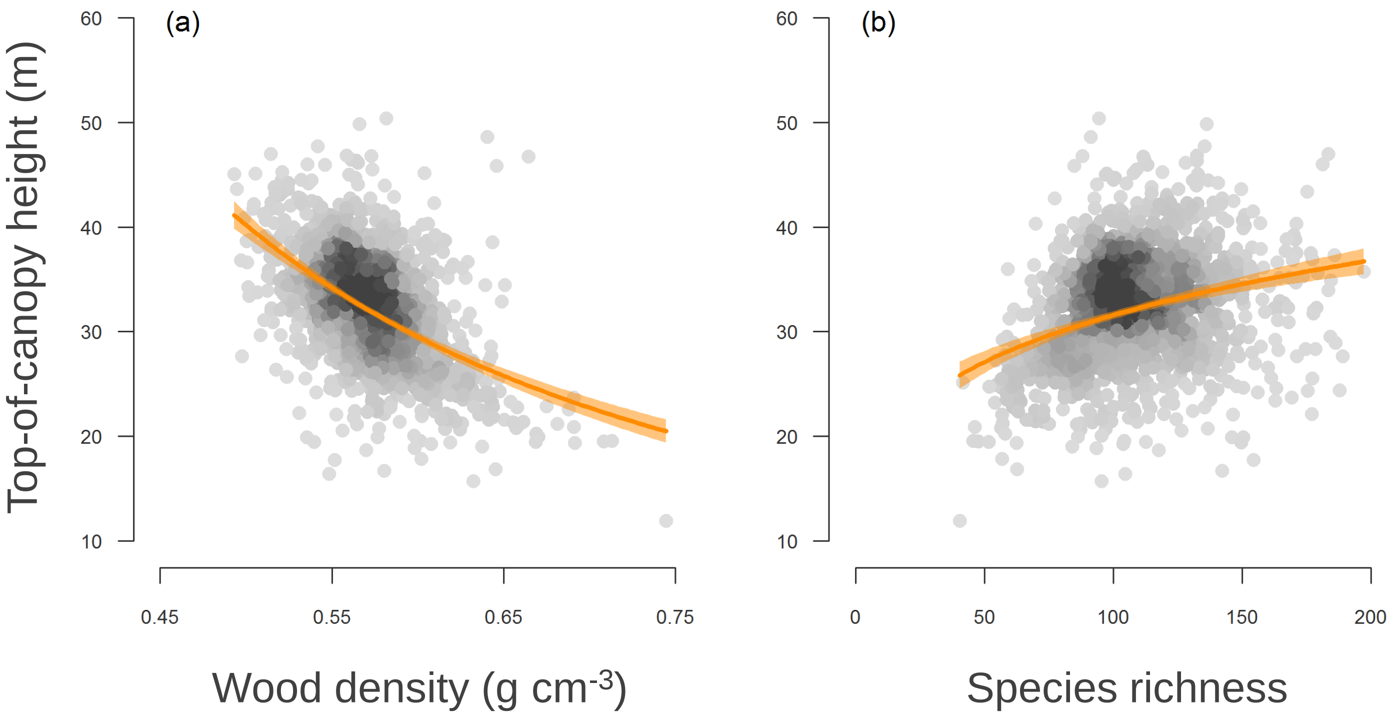
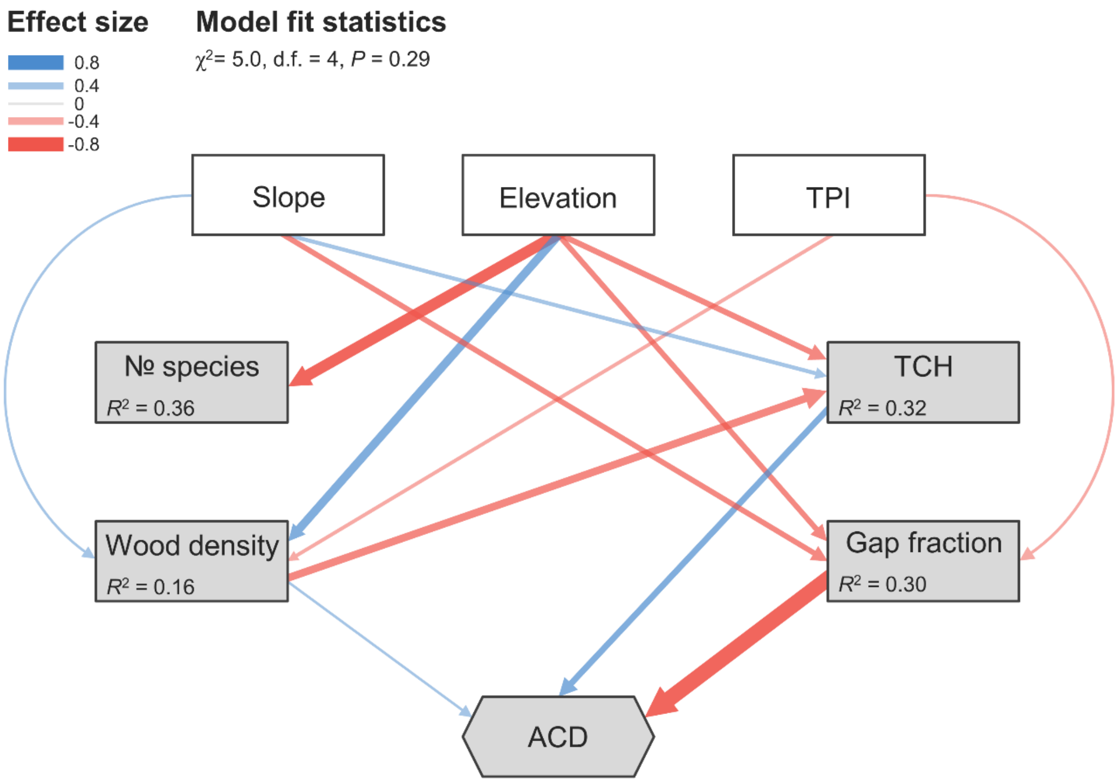
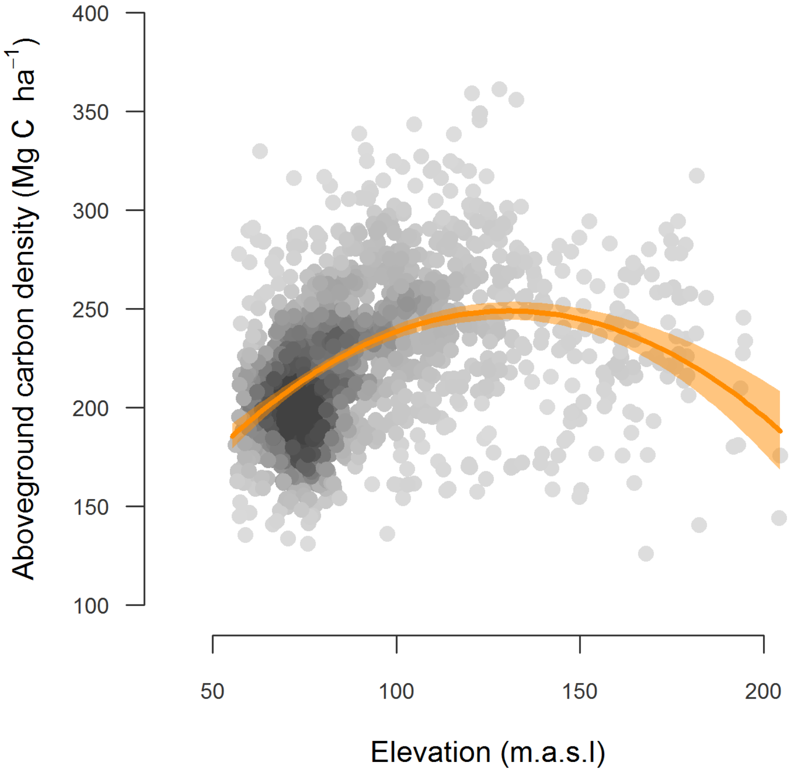


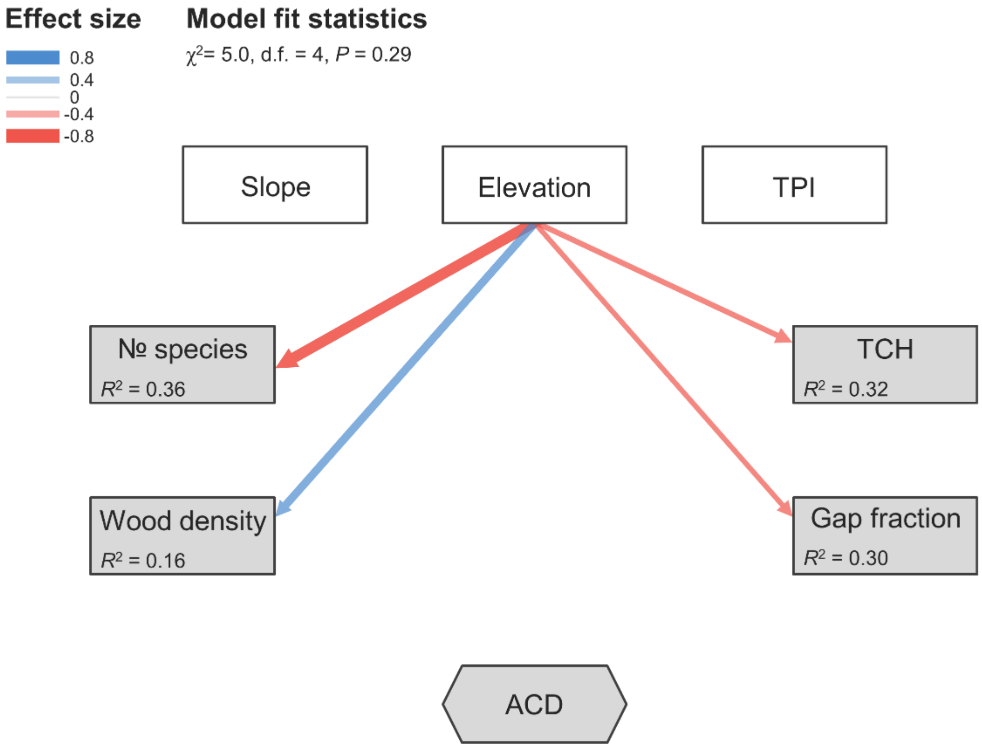
Topography & carbon stocks



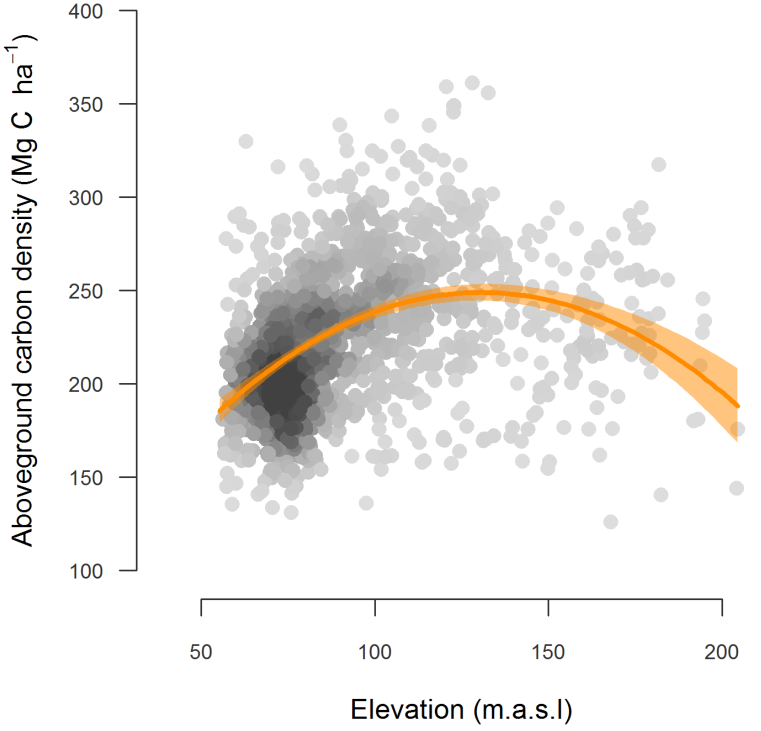
Topography & carbon stocks



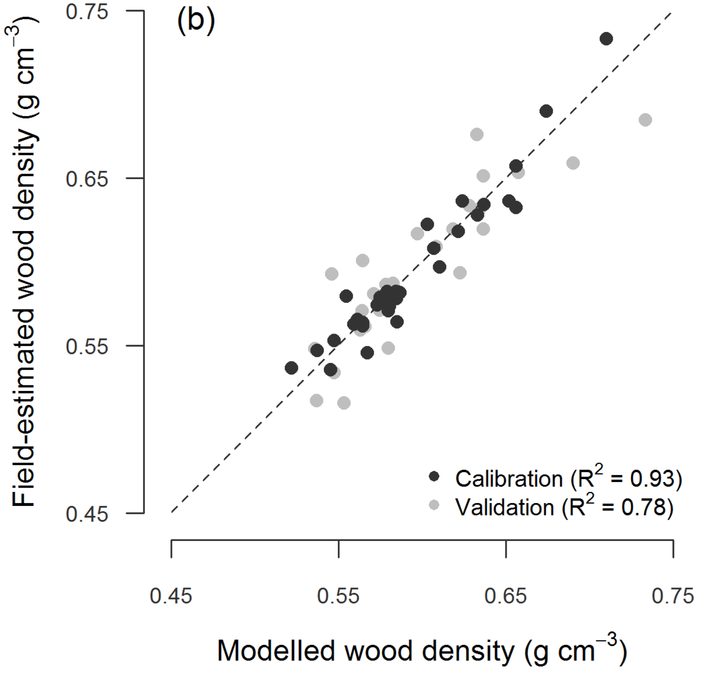
1. Elevation as a key driver of forest structure, composition & diversity



2. Complex relationship between carbon stocks and topography



3. Better estimates of wood density from hyperspectral imagery



4. Carbon – biodiversity co-benefits in human modified tropical forests

Source: Wikimedia Commons