PROJECT FACTSHEET

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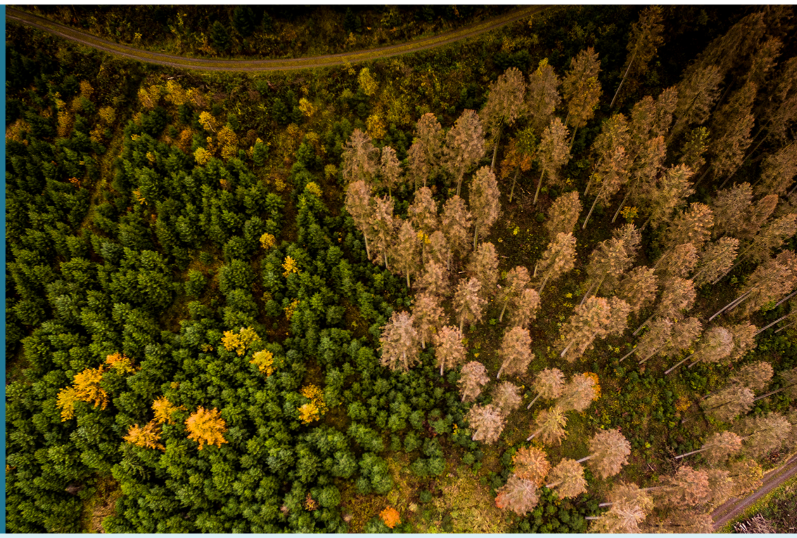
CAPACITY

Plant hydraulics response to extreme climate conditions



Inspiration

Future climate projections suggest an intensification of droughts under global warming. This has triggered interest in vegetation response to extreme climate conditions. Land surface models are tools of choice in this respect: they are designed to assess the impact of climate-induced stresses on ecosystem functioning and understand their propagation through soil-vegetation-atmosphere feedback mechanisms. Yet, several studies show a systematic overestimation of drought effects simulated with a wide range of land surface models.

These deficiencies have stimulated the integration of an advanced representation of vegetation characteristics based on an explicit link between stomatal regulation and root water uptake through the plant hydraulic transport network. The theoretical foundation of this hydraulic approach opens new avenues to improve drought prediction capabilities, and prospects efficient ways for conditioning land surface models response by assimilating measurements of the actual plant water status.

Innovation

The CAPACITY project aims at investigating the sensitivity of stomata regulation and root water uptake as reflected in the simulated evaporation and transpiration responses due to uncertainty inherited in the plant hydraulic traits. To this aim, LIST researchers will develop a comprehensive multi-scale and multi-temporal numerical simulation framework across different ecosystems and environmental gradients in Europe. They will rely on three main pillars, including the state-of-the-art land surface model CLM (version 5.0), as well as plant hydraulics information as extracted from globally assembled and continuously updated databases of plant traits, and synergies with thermal remote sensing-based evaporation estimates using the non-parametric surface energy balance model STIC (version 1.2).

Impact

The systematic analysis of abiotic (climate) and biotic (plant hydraulics) controls on drought prediction uncertainty will be key for further improvements in early-warning predictions based on land data assimilation systems. Furthermore, results of the CAPACITY project will shed light on the potential of the detailed plant hydraulic theory for an improved prognosis of large-scale impacts of extreme climate conditions on vegetation, which could foster its implementation in next-generation climate model projections.

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