

Research Unit Forest Dynamics - colloquium

Date: 05.05.2025
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Room: Engler-Saal
Duration: 45 minutes
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Chairs: Kerstin Treydte, Yann Vitasse

Title: Global forest thickening

Abstract:

While a substantial C sink in terrestrial ecosystems is observed, its attribution to ecosystem types, processes, and geographical locations is unclear. In particular, the contribution of mature forests to the terrestrial C sink is debated. Classical theory predicts that biomass stocks of mature forest stands reach a carrying capacity, expressed by (a temporally constant) self-thinning relationship, and determined by the abiotic environment. However, empirical evidence for this prediction is ambiguous and several types of observations suggest a sustained C sink in biomass of mature forests. In this talk, I will address the question: Does the acceleration of tree growth lead to a sustained C sink (also in mature forests), or does it amplify competition for constrained resources (nutrients, light, water) and accelerate self-thinning under a fixed carrying capacity? To address this question, data from repeated forest inventories of Switzerland are contrasted with schematic simulations of a forest demography model. The analysis of Swiss forests is then extended to forests in all major biomes. We find that forests are thickening in Switzerland and across the globe. This is not a response from past land use but suggests a gradual shift of the carrying capacity under changing environmental conditions. Forest thickening trends are strongest in relatively dry forests. Model simulations suggest that although enhanced tree growth accelerates demographic rates and reduces tree longevity, a positive effect on biomass stocks remains and leads to a general forest thickening and a shifting carrying capacity of mature forests. The pattern of observed trends across global environmental gradients could reflect the combined effect rising light and water use efficiencies of forests under rising atmospheric CO₂.