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Are young trees more tolerant to ongoing climate change than their forebears? Carbon and water dynamics in dry pine forests of Central Valais

Research context and objectives

Given the currently rising temperatures, a “hot topic” today is whether and how forests can adapt to climate change. In a WSL study conducted over a span of a decade within a former wooded pasture situated in Switzerland's driest region, contrasting growth patterns and enhanced resistance to drought in the descendants of aged pine trees were recently detected. These descendants are gradually reclaiming the understory of currently extensively managed forest areas. The growth data collected thus far indicates that the younger trees have adapted to depleting water resources, using them in a more efficient way. The primary aims of this master's thesis are to 1) uncover the mechanisms responsible for the improved ability of young pine trees to better withstand drought stress and 2) investigate the carbon and water dynamics at both the individual tree and ecosystem levels.

Research program

Dry forests at low elevation in the inner Alpine valleys have been showing recurring tree death, the causes of which are investigated by WSL. The Salgesch experiment studies the response at tree and ecosystem level to changes in land use and climate in a former wooded pasture gradually reclaimed by mixed forests. A network of plots centred on either one old or one young pine tree (*Pinus sylvestris*) has been established within a dry forest stand (*Odontito Pinetum*), with the understory removed in part of the plots to study the competition for scarce groundwater. Trees and ecosystem responses are monitored by means of soil and stem sensors. To test the ecophysiological adaptations of young *versus* old trees, the water use efficiency and plant physiological responses will be assessed based on carbon, oxygen, and hydrogen isotopes in wood and foliage. This data will be compared to other indicators of foliage adaptation and activity (*e.g.* morphological traits, needle elements). Furthermore, the yearly water uptake dynamics of trees and the influence of understory competition will be characterized, analyzing oxygen and hydrogen isotopes in water samples extracted from plant material and soil cores taken at several depths. The detailed research program will be determined in close collaboration with the thesis candidate. This master topic is ideally suited for students interested in plant and soil ecology. It includes technical work in the field and in the laboratory.

Referees
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Prof. Dr. Torsten Vennemann (UNIL; thesis co-supervision, isotopes)
Dr. Marco Lehmann (WSL; referee, plant isotope and ecophysiology)

Work place UNINE, WSL, Salquenen/VS

Languages French, English

Link https://www.wsl.ch/de/projekte/experiment-understory-removal-salgesch.html

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