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Considerations for Sustainable Biomass Production in Quercus-Dominated Forest Ecosystems

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Our current energy system is mainly based on carbon (C) intensive metabolisms, resulting in great effects on the earth's biosphere. The majority of the energy sources are fossil (crude oil, coal, natural gas) and release CO_2 in the combustion (oxidation) process which takes place during utilization of the energy. C released to the atmosphere was once sequestered by biomass over a time span of millions of years and is now being released back into the atmosphere within a period of just decades. In the context of green and CO_2 neutral Energy, there is an on-going debate regarding the potentials of obtaining biomass from forests on multiple scales, from stand to international levels.

Especially in the context of energy, it is highlighted that biomass is an entirely CO_2 neutral feedstock since the carbon stored in wood originates from the atmospheric CO_2 pool and it was taken up during plant growth. It needs systems approaches in order to justify this statement and ensure sustainability covering the whole life-cycle from biomass production to (bio)energy consumption.

There are a number of Quercus woodland management systems focussing solely on woody biomass production for energetic utilization or a combination with traditional forestry and high quality timber production for trades and industry. They have often developed regionally as a consequence of specific demands and local production capacities, which are mainly driven by environmental factors such as climate and soil properties.

We assessed the nutritional status of a common Quercus-dominated forest ecosystem in northern Austria, where we compared biomass- with belowground C and nutrient pools in order to identify potential site limits if the management shifts towards systems with a higher level of nutrient extraction. Heterogeneity of soils, and soil processes are considered, as well as other, growth-limiting factors (e.g. precipitation) and species-specific metabolisms and element translocation.