



Nitrogen related constraints of carbon sequestration by afforestation under management and climate scenarios

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Land use change and land management contribute to the exchange of greenhouse gases and are an important factor for man-made climate change. However, land use and land management can also be used to counteract climate change, which is analysed in this study.

Large-scale afforestation is expected to increase terrestrial CO₂ uptake due to expansion of forested areas and due to higher biomass production under CO₂ fertilization. Management of those areas, particularly harvesting biomass, is an important factor influencing the CO₂ sequestration potential. However, productivity of forests can be limited by N availability. Especially under higher harvest, nutrients are continuously removed from the ecosystem which is then prone to nutrient limitation.

In this study, the interference of N availability with the C-sequestration potential of afforestation and land management under climate change conditions is quantified by conducting scenario simulations with the land component of the MPI Earth System Model. Especially the efficiency of applying N fertilizer to counteract N limitation under moderate and high harvest, and potential offsets due to higher N₂O emissions, are shown.