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Optimisation of biomass productivity of black locust (Robinia pseudoacacia L.) on marginal lands – a case study in Lower Lusatia, NE Germany

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The profitability of reclaiming post-mining areas depends on the tree biomass productivity and the restoration of ecosystem functions, such as improving soil and water quality. Agroforestry systems, regarded as combined land-use systems of trees and crops, have the ability to facilitate soil development while reducing wind speed, soil erosion and evaporation. Achieving the maximum biomass productivity of the tree stands depends on the corresponding soil conditions and water availability, but is also influenced by stand structure and the competition between individual trees. For this purpose, black locust (Robinia pseudoacacia L.) trees were planted in a Nelder design in 2010, on a reclaimed post-mining site of the open-cast lignite mining in Welzow Süd (Brandenburg, Germany). Black locust is regarded as a drought-adapted tree species and commonly used for the reclamation of former lignite mining sites in Lower Lusatia, Germany. The Nelder design encompasses angles of arc of equal measure and with the same origin traversed by successive circumferences set at a predefined radial distance. Accordingly, a total of 1071 trees were planted in Welzow Süd at the intersection between 63 spokes and 17 circumferences and at densities ranging from 0.4 to 8.0 m2, with the aim of examining the influence of stand density on the tree growth in a timeframe of six years. In order to evaluate the biomass production of the trees and to determine an optimal planting density on a marginal land, various scenarios were assessed with the help of the Yield-SAFE model, a parameter-sparse process-based agroforestry model. The study revealed the consequences of choosing different tree densities on the tree biomass productivity and water use of trees in relation to the competition for light and water.

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