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Carbon sequestration in litterfall, forest floor, roots and soil in *Robinia pseudoacacia* restoration plantations.

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The restoration of degraded land after mining with the establishment of forest plantations, contributes to climate change mitigation by enhancing carbon storage. For this purpose, around 2,570 hectares at the Lignite Center of the Hellenic Public Power Corporation in Western Greece were planted with black locust (*Robinia pseudoacacia* L.), since it is a fast-growing, drought-tolerant species with N-fixing capacity. The aim of this study, which was carried out within the COFORMIT project, was to estimate the C fluxes of litterfall, forest floor and fine roots (<2mm in diameter), and the C stocks of coarse roots (≥2mm in diameter) and soil in these plantations and to examine how they are affected by seasonal variability, canopy density, soil depth. Sampling was performed in 18 plots of higher and lower canopy density (36 plots in total). In each plot, litterfall and forest floor were sampled bimonthly, while soil samples were collected once at two depths (0-10cm, 10-30cm). To estimate carbon stocks in coarse roots, the root system of five black locust individuals, representative of the 5 classes of diameter at breast height (DBH) have been excavated. For the determination of carbon fluxes of fine roots, 12 cores were sampled around the perimeter of each selected tree. To assess fine root turnover, 48 in-growth cores had been placed around four trees with varying DBH. Carbon fluxes of litterfall and forest floor peaked from October till December in both pools. Total carbon sequestration in litterfall was 1.39 t ha^{-1} yr^{-1} and it significantly increased with increasing canopy density. Mean annual carbon in forest floor was 2.98 t ha^{-1} yr^{-1}, which was not significantly affected by canopy density. The carbon sequestration in coarse roots was 12.89 t ha^{-1}. Fine roots stored c. 0.27 t ha^{-1} of carbon, while no effect of soil depth (0-10 cm vs. 10-30 cm) was detected. Fine root turnover was 0.17 t ha^{-1} yr^{-1} and it also did not differ with soil depth. Soil organic carbon (SOC) increased greatly with depth (from 19.57 t ha^{-1} in 0-10 cm to 33.19 t ha^{-1} in 10-30 cm) and in total (52.75 t ha^{-1}) was higher than the SOC levels reported in literature for black locust plantations of the same age, possibly due to the presence of lignite mining residues. Our results support the significant carbon sequestration potential of the studied restoration plantations and are discussed in relation to findings from other black locust restoration schemes.

Keywords: CO_2 sequestration, black locust, post-mining rehabilitation, soil organic carbon, forest floor, litter, below-ground biomass.

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