

9.土地资源与土地系统：认知，感知与模拟

全球土壤有机碳周转与农田土壤固碳

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摘要： Upon analyzing observational carbon input and radiocarbon data in global soil profiles, we found that approximately 25% of new carbon entering the soil exits within a year, irrespective of entry depth, leaving only about 13% after 30 years. Notably, the majority of soil organic carbon (SOC) across all soil depths is aged over 30 years, underscoring the low transfer efficiency of carbon inputs to aged SOC crucial for long-term SOC sequestration. In the context of croplands, our focus was on quantifying the required carbon input rates to maintain and enhance China's cropland SOC levels to align with the global average. Model simulations indicate that an average input of $2.1 \text{ Mg C ha}^{-1} \text{ year}^{-1}$ is necessary to prevent soil C loss, with the potential to raise SOC density to the global mean of 55 Mg C ha^{-1} by 2050 by incorporating $5.1 \text{ Mg C ha}^{-1} \text{ year}^{-1}$ into the soil. To further this research, a hybrid approach integrating agricultural system modeling, machine learning, and life cycle assessment is recommended to optimize fertilizer application, irrigation, and residue management spatiotemporally in the North China Plain.

关键词： 土壤有机碳、周转时间、年龄、固碳