Effect of Biochar on Carbon Budget of Forest Ecosystems and Long-Term Verification of Carbon Sequestration

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Forests store large quantities of carbon globally. However, a decrease in the forest area is considered to contribute to global warming. Protecting forest ecosystems is vital for curbing global warming. Therefore, forest carbon fixation requires further improvement. This study aimed to assess the duration of carbon sequestration and the effect of biochar on the carbon budget. We established two study plots at our school in Yokohama, Japan, in 2020 and applied 10 t ha-1 of biochar to one of the plots. We estimated the carbon cycle using net primary production (NPP) and soil respiration (SR) from 2021 to 2024. NPP was quantified from tree growth (?B) and litterfall (LF). SR was calculated by measuring the soil respiration rate and continuous soil temperature. Although the NPP decreased in both plots, the reduction was lower in the biochar plot than in the control. ?B in the biochar plot tended to maintain over a longer time compared to the control. In addition, ?B in some trees in the biochar plot whose DBH (Diameter at Breast Height) was between 10 and 20 cm was significantly higher. The LF of leaves in the biochar plot increased. Although the biochar application-related SR increase caused concerns, it remained limited to the first year of this study. Our results suggest that biochar improves carbon fixation and sequestration in forests. Therefore, biochar application has considerable advantages in green urban areas such as the venues of our school.

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