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Variation in soil organic carbon fractions and microbial community activities in response to vegetation succession in degraded karst terrain
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Abstract
The community of vegetation in a particular area affects soil processes such as nutrient cycling that are likely to be mediated by soil microorganisms in the forest ecosystem. We compared the changes in the soil microbial community and its function and organic carbon fractions during vegetation succession in degraded karst terrain in southwest China. Topsoil samples were collected in a successive series of samples that were harvested from a vegetation community as it changed from deciduous broad-leaved trees (FO) toward shrubs (SH) and shrubs-grasses (SHG). Soil organic carbon (SOC), total nitrogen (TN), labile organic carbon (LOC), water extractable organic carbon (WEOC) and microbial biomass carbon and nitrogen (MBC and MBN) were all assayed. In addition, soil bacterial and fungal diversity were assayed by polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE). The soil enzymatic activities of urease and invertase were also determined. The results showed that SOC, LOC, MBC, MBN and the enzymatic activities all declined with vegetation succession. MBC, MBN and the enzymatic activities demonstrated relatively strong declines, while WEOC was higher in SHG than in other systems. Moreover, the coefficients of variation (CV) for the microbial biomass and enzymatic activities were higher than that of the soil nutrients properties, reflecting the fact that soil microbial properties are more sensitive to vegetation sifts than soil nutrients. Additionally, analysis of SH and SHG did not reveal a significant difference in soil bacterial and fungal composition, while FO was different from both SH and SHG, reflecting the fact that vegetation conversion from broadleaved trees to shrubs or shrubs and grasses altered the soil microbial community. The percentage of LOC/SOC was higher in FO and SH than in SHG. MBC/SOC significantly declined with vegetation succession, and MBC/LOC was higher in FO than SH and SHG. Moreover, MBC, MBN and urease activities were found to correlate with SOC, LOC and TN ($p < 0.01$). These results suggest that vegetation conversion resulted in significant changes in carbon input and bioavailability, which in turn impacted the soil microbial community and its function in the forest ecosystem.