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Contrasting responses of soil fungal communities and soil respiration to the above- and below-ground plant C inputs in a subtropical forest

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The roles of soil fungal diversity and community composition in regulating soil respiration when above- and below-ground plant carbon (C) inputs are excluded remain unclear. In the present study, we aimed to examine: (i) how does the exclusion of above- and below-ground plant C inputs affect soil respiration and soil fungi singly and in combination? and (ii) are changes in soil fungal diversity aligned with changes in soil respiration? A field experiment with manipulation of plant C inputs was established in a subtropical forest in southwest China in 2004 with litter removal and tree stem-girdling to exclude inputs of the above- and below-ground plant C, respectively. In 2009, we measured the rates of soil respiration with an infrared gas analyser and soil fungal community structure using Illumina sequencing. We found that the rates of soil respiration were reduced significantly by litter removal and girdling, by similar magnitudes. However, they were not decreased further by the combination of these two treatments compared to either treatment alone. In contrast, litter removal increased the diversity of soil fungal communities, whereas girdling decreased the abundance of symbiotrophic fungi but increased the abundance of saptrotrophic and pathotrophic fungi. These changes in soil fungal community might initiate CO2 emission from soil C decomposition, offsetting further decline in soil respiration when plant C inputs are excluded. These results revealed that the exclusion of the above- and below-ground plant C inputs led to contrasting soil fungal communities but similar soil function. Our findings suggest that both above- and below-ground plant C are important in regulating soil respiration in subtropical forests, by limiting substrates for soil fungal growth and altering the diversity and composition of soil fungal community.