

Global meta-analysis shows that climate and land use disturbances increase forest soil CO₂ efflux

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Abstract

Forest soil CO₂ efflux (F_{CO_2}) is a crucial process in global carbon cycling; however, how F_{CO_2} respond to disturbance regimes in different forest biomes is poorly understood. We quantified the effects of disturbance regimes on F_{CO_2} across boreal, temperate, tropical, and Mediterranean forests based on 1240 observations from 380 studies. Globally, F_{CO_2} was increased by 13 to 25% due to climatic perturbations such as elevated CO₂ concentration, warming, and increased precipitation. F_{CO_2} was increased by forest conversion to grassland and elevated carbon input by forest management practices but was reduced by decreased carbon input, fire, and acid rain. Disturbance also caused changes in soil temperature and water content, which in turn affected the direction and magnitude of disturbance effects on F_{CO_2} . Our results suggest that disturbance effects on F_{CO_2} should be incorporated into earth system models to improve the projection of feedback between the terrestrial C cycle and climate change.

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