



Disturbance and Recovery in Terrestrial Ecosystem Carbon Cycling-a Global Synthesis

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Disturbances have been shown by many studies to trigger the release of large amounts of carbon and then influence climate change. Ecosystems usually recover after disturbances, potentially compensating the released carbon. However, it's not clear what states the ecosystems would recover to after disturbances and how long it takes to recover. We synthesized results from peer-reviewed papers that examined ecosystem recovery following disturbances. A total of 94 case studies that had complete cycles of pre-disturbance-disturbance-recovery were included in this synthesis. Disturbance severity, recovery time, and state shifts were quantified for each variable. The results showed that most variables recovered to their pre-disturbance states. But the recovery time changed greatly among variables, ecosystems, and disturbance types, with long recovery time for soil C (101 years) and short time for NPP (56 years) and litter accumulation (34 years) after fire. Recovery time was shorter in grasslands than forests, and shorter from droughts (climate extremes) than fire and deforestation. Moreover, the recovery time was related to disturbance severity. The severer the disturbance, the longer the recovery time is. State changes that after disturbances ecosystems recovered to states that differ from the pre-disturbance ones was detected for many variables. NPP and litter accumulation after the full recovery following fire disturbances exceeded the pre-disturbance states while the fully recovered total aboveground biomass and soil carbon after the disturbances differed little from the pre-disturbance ones. The results indicate that it's crucial to quantify the disturbance impacts on ecosystems by considering the disturbance severity and state shifts.