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Contributions of Primary and Secondary Forests, and Nitrogen Dynamics to Terrestrial Carbon Uptake

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Historically, land use change (LUC), such as the conversion of forests to croplands and pasturelands, has generally released C to the atmosphere due to the burning of forest biomass and subsequent decomposition of the dead organic matter. In recent decades, C stocks in forest ecosystems have increased through reforestation, afforestation and forest regrowth on abandoned land. However, the accumulation of C in regrowing forests can be constrained if the regrowth of forest occurs in N limited regions or enhanced if the additional N is deposited in the forest regrowing regions. While the C sinks associated with regrowth of forest are commonly simulated within terrestrial C cycle models, the impacts of N limitations and N deposition on the C sink associated with regrowing primary and secondary forests have often not been considered. The objectives of this presentation are to use the Integrated Science Assessment Model (ISAM), which couples the terrestrial C and N cycles for global change assessments, to examine the nitrogen limitation in global primary and secondary forests from historical LUCs and the interactions between LUCs and N deposition. This study presents several crucial updates on multiple fronts, in particular, a use of fully coupled biogeophysical and carbon-nitrogen (C-N) cycle component of the ISAM, incorporating the impact of N limitation and N deposition on the GPP, NPP and associated with primary and secondary forest regrowth including the effects of wood harvest activities, a use of the most recent satellite data for LUC, and extending the estimates until the year 2012.