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Evolution of nitrogen cycling in regrowing Amazonian rainforest

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Extensive regions of tropical forests are subjected to deforestation, in the Brazilian Amazon region alone 800 000 km2, but there is also an increasing area of secondary tropical forests established after abandonment of cultivation. Deforestation and forest regrowth both strongly affect soil nutrient cycling, but our knowledge of nutrient availability and biogeochemical processes during post-disturbance regeneration is limited. Along a forest chronosequences in the Amazon region it was earlier shown, using indicators based on soil inorganic N contents, that young successional tropical forests have a conservative N cycling. In this study, we aimed to investigate mechanistic changes in the soil N cycle (gross N mineralization and nitrification) during forest regrowth in Amazonian forests. Our results show that gross nitrification were lower in all ages of forest regrowth (10 to 40 years) compared to pristine forest and that this explained the observed changes in the soil nitrate-to-ammonium ratio. This indicates the evolution of a more conservative and closed N cycle in regrowing forests, reducing the risk for N leaking out of the ecosystem. Furthermore, our results indicate that mineralization and nitrification are decoupled in young regrowing forests, such as that high gross mineralization is accompanied by low gross nitrification, indicating a closed N cycle at the same time maintaining N supply for forest regrowth. We conclude that the status of gross nitrification in disturbed soil is a key process to understand the recovery of nutrient cycling in tropical forest regrowth.