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Nitrogen loss from unpolluted South American forests mainly via dissolved organic compounds

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Conceptual^{1, 2, 3, 4} and numerical^{5, 6, 7, 8} models of nitrogen cycling in temperate forests assume that nitrogen is lost from these ecosystems predominantly by way of inorganic forms, such as nitrate and ammonium ions. Of these, nitrate is thought to be particularly mobile, being responsible for nitrogen loss to deep soil and stream waters. But human activities—such as fossil fuel combustion, fertilizer production and land-use change—have substantially altered the nitrogen cycle over large regions⁹, making it difficult to separate natural aspects of nitrogen cycling from those induced by human perturbations¹⁰. Here we report stream chemistry data from 100 unpolluted primary forests in temperate South America. Although the sites exhibit a broad range of environmental factors that influence ecosystem nutrient cycles^{11, 12, 13} (such as climate, parent material, time of ecosystem development, topography and biotic diversity), we observed a remarkably consistent pattern of nitrogen loss across all forests. In contrast to findings from forests in polluted regions, streamwater nitrate concentrations are exceedingly low, such that nitrate to ammonium ratios were less than unity, and dissolved organic nitrogen is responsible for the majority of nitrogen losses from these forests. We therefore suggest that organic nitrogen losses should be considered in models of forest nutrient cycling, which could help to explain observations of nutrient limitation in temperate forest ecosystems.

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