A Selfish Microbe Model of Nitrogen Trace Gas Metabolism. (4911)

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Abstract:

N-containing trace gases influence global climate. Their terrestrial production is tricky to model because of spatial and temporal variability, increasing arrays of organisms and metabolisms involved, oxidation-reduction couples associated with energy transduction, and chemical as well as biological transformations. Potential approaches to modeling include: regression on supply of reduced or oxidized substrates, modeling redox potential, using soil water as a surrogate for restrictions in oxygen supply, modeling nitrous oxide release during denitrification using electron supply and oxygen diffusion or during nitrification using a leaky pipe concept. These approaches follow classical concepts of N transformation in which suites of organisms sequentially oxidize or reduce N, and the balance is governed by oxygen supply in a syntropic system. An alternate, Selfish Microbe Model hypothesizes that maximization of energy capture from scarce substrates using thermodynamically favorable reactions drives evolution, and competitive advantage can result from depriving a competitor of substrate. The Selfish Microbe Model changes concepts of production of N-containing trace gases; it unifies understanding of N oxidation and reduction, predicts that N-containing trace gases should be released during N oxidation, and is consistent with observations of anaerobic ammonium oxidation.

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