ID: W2149352713

TITLE: Nitrogen Cycles: Past, Present, and Future

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ABSTRACT:

This paper contrasts the natural and anthropogenic controls on the conversion of unreactive N2 to more reactive forms of nitrogen (Nr). A variety of data sets are used to construct global N budgets for 1860 and the early 1990s and to make projections for the global N budget in 2050. Regional N budgets for Asia, North America, and other major regions for the early 1990s, as well as the marine N budget, are presented to Highlight the dominant fluxes of nitrogen in each region. Important findings are that human activities increasingly dominate the N budget at the global and at most regional scales, the terrestrial and open ocean N budgets are essentially disconnected, and the fixed forms of N are accumulating in most environmental reservoirs. The largest uncertainties in our understanding of the N budget at most scales are the rates of natural biological nitrogen fixation, the amount of Nr storage in most environmental reservoirs, and the production rates of N2 by denitrification.

SOURCE: Biogeochemistry

PDF URL: None

CITED BY COUNT: 4437

PUBLICATION YEAR: 2004

TYPE: article

CONCEPTS: ['Denitrification', 'Environmental science', 'Reactive nitrogen', 'Nitrogen', 'Nitrogen fixation', 'Ecosystem', 'Nitrogen cycle', 'Ecology', 'Physical geography', 'Earth science', 'Geography', 'Biology', 'Geology', 'Chemistry', 'Organic chemistry']