

## 2. Nitrogen flow

flow	magnitude [ $10^{12}$ kg(N)/yr]
ammonification (production of $\text{NH}_4^+$ from organic nitrogen, the end stage of decomposition)	5
assimilation (conversion of $\text{NH}_4^+$ and $\text{NO}_3^-$ to protein by vegetation and microbes; very roughly, one half of the nitrogen is assimilated as $\text{NH}_4^+$ and one half as $\text{NO}_3^-$ , which was nitrified from $\text{NH}_4^+$ )	5
natural background flow of $\text{NH}_3$ and $\text{NO}_x$ from soil and water to the atmosphere	0.5
precipitation of $\text{NH}_4^+$ and $\text{NO}_x$ to Earth's surface in rain and snow	0.1
denitrification (conversion of soil and water $\text{NO}_3^-$ to atmospheric $\text{N}_2$ or $\text{N}_2\text{O}$ , whose production rates are very roughly equal)	0.1
biological nitrogen fixation (about two thirds by continental organisms, one third by marine) including legumes	0.2
global industrial nitrogen fixation in 2000 [Contributions from fossil fuel combustion was about one third of total; the remainder is mostly fertilizer production.]	0.12
river flow of fixed nitrogen to sea	0.01
fixation of atmospheric $\text{N}_2$ by lightning	0.01
production of stratospheric NO from $\text{N}_2\text{O}$	0.001

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