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Plausibility of New Paradigms in Terrestrial Nitrogen Cycle

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During the last decade, progress in the understanding of terrestrial nitrogen cycle stress the challenge of rethinking our conceptual model of global nitrogen cycle in a changing world. Our current N cycle paradigms postulate: 1) inorganic soil N as the main source of plant N, since the plant ability to take up organic N is uncommon in nature, 2) atmosphere as the solely source of new N, disregarding the possibility of bedrock N as an important nutritional source, and 3) symbiotic N fixing in plant as the key process introducing new N from the atmosphere, overlooking biological crusts and N fixing free living organisms as important players. Since recent evidence suggest an important role of bedrock N, biological crusts and N fixing free living organisms as well as a wider distribution of plants capable of taking up organic N, here we discuss the plausibility of a paradigm's change based on worldwide application of new ideas at ecosystem level. Applying these new paradigms at ecosystem level we found that plants uptake of organic N was not worldwide distributed but rather restricted to ecosystems with low temperature, precipitation, total annual radiation and soil carbon availability (low energy availability). Despite the importance of biological crusts had been confined to arid systems, their wide distribution conferred them with $\sim$40% of our current global estimation of N fixing. Furthermore, N fixing by free living organisms was more important in agroecosystems and natural ecosystems where temperature range is closer to the optimum for nitrogenase activity and where plant community is limited by P. Since the importance of bedrock N to N ecosystem storage depends on the global distribution of N rich sedimentary rocks and because it has not a worldwide homogeneous distribution, the relevance of that N source was confined to ecosystems capable of biomass storage over long time periods and to ecosystems with low fire frequency. While evidences supporting the plausibility of incorporating new ideas to the terrestrial N cycle, a redraw of the global nitrogen cycle is conditioned to further investigation about the effects of contemporary climatic change over these novel N cycle players.