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Why should we consider alternative nitrogenases in boreal ecosystems?

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Biological nitrogen fixation (BNF) is the main source of new nitrogen (N) for the biosphere, accounting for up to 97% of N input in unmanaged terrestrial ecosystems. This reaction is catalysed by the enzyme nitrogenase (Nase). In N2 fixers associated with higher plants, only the molybdenum (Mo) dependent nitrogenase (Mo-Nase) has been identified. However, in many other N2 fixers two additional isoenzymes have been reported; the vanadium (V) dependent (V-Nase) and iron-only dependent nitrogenase (Fe-Nase). The role of these alternative nitrogenases (V-Nase and Fe-Nase) in natural habitats has been mostly overlooked, because they are found in communities that were not considered major contributors to N inputs. In recent years, N2 fixation associated with mosses and lichens has captured the interest of the scientific community for its importance toward global N input in high latitude ecosystems. Within this context, it is imperative to reconsider the role of alternative nitrogenases in these biomes.

Here, I will present an overview of various findings, provided by different research groups, in the last two decade, suggesting that alternative nitrogenases could play an important role on N2 fixation in terrestrial ecosystems, especially in high latitude ones. I will discuss how these findings challenge the traditional view of Mo hegemony on N input in natural habitats and how it affects our conceptual models relating N2 fixation and trace metal dynamics in the environment.

I will conclude by presenting my views on the importance to improve our understanding of the role of alternative nitrogenase in high latitude ecosystems; not only will this affect our fundamental understanding of N2 fixation and N cycling, it will also impact our ability to predict the response of these ecosystems to global climate change.