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## The integration of element cycles: contrasting perspectives from natural and managed systems in global change research

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Despite the ecological connection between natural and managed systems, they are often studied separately, by different research groups. This echoes the focus of this session that, despite the tight coupling of carbon (C) and nitrogen (N), global change investigations of these element cycles may be carried out by different research groups. This talk will address the contrasting approach to integrating element cycles between researchers in natural and managed systems.

Global change research in natural systems has focused on predicting the C balance of the system. Integrating research between C and other element cycles makes sense in this situation, because the growth and activity of the research organisms (animals, plants, microorganisms) are limited by other elements. This stoichiometric theory (multiple limitation hypothesis) has been investigated for at least three decades, and although C and other elements are often studied independently, many researchers in natural systems have embraced this elemental integration in their global change research.

Managed systems also have a long history of element limitation research, primarily NPK, with a focus on maximising plant growth and the economy of fertiliser use efficiency. However, natural climate solutions - necessary because mandatory reductions in fossil fuel emissions are insufficient to meet climate targets - often rely on sequestering C in biomass and soils, changing the focus of managed system research to include C. As we know from our research in natural systems, the process of C sequestration is tightly coupled to N (and other elements). Unfortunately, most soil C process models or earth system models do not include N (or other elements). Very few soil C sequestration predictions include the C-cost of N<sub>2</sub>O losses - an important trade-off in N-saturated systems - primarily because there has been insufficient research into the microbial interdependency of C and N in managed soils.

In this talk I will discuss recent insights into how the integration of C and N (and other elements) in the ecological research of managed systems can improve our ability to mitigate the consequences of global change.