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Leaf trait response to nutrients and herbivore exclusion across a globally replicated grassland experiment

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Functional trait research has developed with the aim of finding general patterns in how the function of plant assemblages changes with respect to different land-uses. Most studies have compared sites within and across regions with variations in land-use history, but not necessarily with standardized treatments in an experimental framework. The trends that have emerged from this research is that characteristics of leaf traits such as specific leaf area (SLA) correlate with carbon acquisition strategies known to influence ecosystem functioning. SLA has been found to represent a plant's investment in growing light-capturing area per dry mass content. Species with a relatively high SLA tend to have a higher rate of return on the resources invested into making tissue (cheaper leaves in terms of energy and resources needed to produce them) when compared to species with a lower SLA (more expensive leaves to produce). Few studies have examined quantitatively measured traits in an experimental framework. The Nutrient Network experiment, globally distributed experiment, presents a unique opportunity to examine the response of functional traits across grassland ecosystems characterised by a diverse range of climatic conditions and subjected to the same set of experimental treatments. The main aim of this paper is to quantify how changes in nutrient availability (NPK fertilizer application in all factorial combinations) and grazing alter the functional leaf traits of species over the short-term. Our results show that SLA varies at a site level ($\sim$75% of the variation in SLA in response to treatments were explained at the site level). Leaf nitrogen (%), leaf phosphorous and leaf potassium varied significantly depending on treatment and where respective nutrients were added. Variation in leaf potassium showed the highest variation between species ($\sim$60%). Overall, we should that leaf nutrient levels are a stronger indicator of functional response to nutrients addition across sites than specific leaf area. These findings have important implications for how leaf functional traits are used to infer responses to pervasive environmental change within and across grassland sites.