# Terrestrial Acidification, Ecotoxicity & Eutrophication Potential are Reduced in Production Systems that Include Perennial Forages

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The negative environmental impacts of conventional forage production management otherwise known as business as usual (BAU), and its associated high energy requirement have become a bottleneck in sustainable agricultural practices due to the use and excessive cost of fertilizer input, which contributes about 50% running cost of this system. Integrating perennial forages into this high external input, and low diversity cropping systems, has become a hotspot in the quest for sustainable management practices and reduction of environmental pollution. Perenniality is a component of the diverse perennial circular systems (DPCS) that can foster resilience in agriculture and a sustainable environment. In this study, a systematic review was conducted on empirical studies of perennial and annual forage production agriculture management systems, to compare their environmental implications via enhancement of terrestrial acidification, ecotoxicity, and eutrophication potential. These ecosystem service indicators were investigated in research articles that included life cycle assessment (LCA), greenhouse gas (GHG) emissions, and climate change studies from national and international regions and grouped by individual and combined management practices related to forage production (grain, hay, silage, or grazing). Also, the number of observations (sample sizes) and information on several factors, or characteristics that may affect the forage cropping system response were collected from each study. The sample sizes were judged based on the impact of BAU, alternative or aspirational system (AS), and DPCS. The results of this study show that the perennial farm management systems have better environmental and economic benefits in the context of reduction of terrestrial acidification, ecotoxicity, and eutrophication potential over the annual forages farm management system. For instance, the integration or production of a perennial forage such as alfalfa (*Medicago sativa* L.) has the potential to act as a natural soil scavenger by preventing nutrients from seeping into the soil, promoting nutrient cycling, soil health, carbon sequestration, and prevention of soil erosion. Information from this study is crucial in management practices, particularly on high-nutrient livestock forage production that needs the integration of perennial forages into high-input, low-diversity cropping systems.

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