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What management options to increase animal nutrition and ecosystemic services?

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O36**Herbivore nutrition, ecosystems and nature-based solutions – what are the sustainability opportunities and trade-offs?**

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Keywords

Sustainability; Ecosystem; Ruminants; OneHealth

The global livestock industry is faced with myriad sustainability challenges relating to the animal-sourced food (ASF) production. In a contemporary utopia, every system would produce ASF with low GHG emissions; high animal welfare, soil health and biodiversity; in a culturally acceptable manner and at an affordable economic cost to the consumer. However, few systems are close to achieving this balance. One of the greatest benefits of grazing livestock systems is the ability to convert human-inedible forages into milk or meat, producing food from land that is unsuitable for cultivation. Well-managed grazing also sequesters carbon into soil, maintains traditional landscapes and improves soil quality and health. However, extensive grazing systems often have higher greenhouse gas emissions. Given the international focus on climate change, these systems may therefore be disadvantaged. Herbivores evolved over thousands of years to live in tandem with billions of vertebrate and invertebrate species. Although modern farming practices have disrupted this link to some degree, many species still rely on grazing livestock to provide suitable habitats and food sources. These vary from wading birds that depend on cattle to keep the grass short enough for ground-nesting in Scotland; to the 500 species of dung beetles in Australia. Livestock production should therefore follow the three pillars of the OneHealth concept – healthy livestock, producing food to nourish healthy people, within a healthy ecosystem health. A clear imperative exists to measure impacts on ecosystem health and to develop nature-based solutions. However, this is not an easy task – there are billions of different herbivorous systems worldwide, all with different climates, breeds, terrains, cultures and communities. Where biodiversity schemes and metrics exist, they are often in their infancy or region/system-specific, yet the need exists to, for example, compare the ecosystem services and opportunities of a smallholder farm in Kenya to a large-scale dairy in the USA. This is further compounded by the complexities of changing human behaviour, both by producers changing their focus from livestock yields to a dual-focus on livestock and ecosystem yields; and consumers in placing greater economic value on products with high ecosystem characteristics. It is therefore necessary to: (1) Recognise sustainability trade-offs and priorities – improving biodiversity may be seen as less important if animal health is poor or food security impaired, yet incremental win-wins may produce exponential improvements. (2) Identify mechanisms and management practices to rebuild and improve ecosystem health, accounting for consumption and climate trends. These should provide multifactorial benefits, and be both applicable and adoptable. (3) Develop metrics, standards and key performance indicators (KPI) that allow quantification of the current status and future gains. (4) Incentivise farmers to change practices and improve ecosystem KPI. (5) Effectively communicate producers' dedication to ecosystem health to consumers, government and stakeholders.

doi: [10.1016/j.anscip.2023.04.037](https://doi.org/10.1016/j.anscip.2023.04.037)**O37****What management options to increase animal nutrition and ecosystemic services?**

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Keywords

Grazing; Meta-analysis; Nutrition; Biodiversity; Ecosystemic services.

Many publications investigate the ecosystemic services (ES) supplied by livestock systems (concepts, framework, principles, evaluation...). At the same time, management options need to be further promoted in existing livestock systems, in order to amplify ES provided. This is all the more urgent considering the existing multidimensional crisis. By combining meta-analysis and targeted experiments, we have highlighted the interest of different management options on pasture, to amplify some ES. Grazing cattle, sheep and goats were compared to their trough-fed counterparts via a meta-analysis. The results highlight that pasture-fed animals have the potential to achieve the same performance as trough-fed ruminants, provided the diet is similar in both feeding systems; on pasture, the carcasses would even have a much more developed muscle mass. Indeed the analysis of the differences showed that there is a confounding effect of the feeding system (grazing vs. stalling) and the nature of the feed; in most studies, stall-fed animals received concentrate whereas pasture-fed animals never are. Mixed grazing can improve grazing intake and average daily gain (ADG) of small ruminants, as well as their parasitic status, contributing to provisioning and regulating ES. For sheep, it has been quantified by meta-analysis an individual gain of 15 g/animal/day (+18%) and a gain of 29% per hectare compared to sheep grazing alone. For goats, a 2-year experiment revealed also an individual gain of 14 g /animal/day, and an overall gain per hectare doubled. Organic fertilization with vermicompost from natural pastures improved the nutrition of grazing lambs and doubled their ADG (68.7 g/d vs 32.3 g/d), while their parasitism was reduced (by 13%) compared to lambs grazing on

unfertilized areas. By meta-analysis we had previously assessed the high quality of manure-based composts, and the interest of earthworms in accelerating the composting process and enriching the compost in P, Ca and Mg. And the impact of earthworms on the parasites excreted in the faeces of the lambs would explain the decrease in parasitism. Additional experiments are in progress. These results illustrate that provisioning and regulating ES by grazing livestock can be increased, in addition to the cultural and supporting ES inherent to pasture, notably by using natural biodiversity. However, the know-how and relevant practices of farmers, are vital for a concrete development of ES, considering the context of each farm (environment, labour force). Thus, in addition to research to assess ES and identify management options, dissemination to farmers for better appropriation and implementation of efficient practices, is requisite. Beyond the action of structures supporting farmers, emphasis should be put on the role to be played by researchers in accelerating the dissemination process, and better contributing to open science and the mediation of results of scientific research.

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O38

Earth needs much herbivory, but the right way: implications for livestock management

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Keywords

Herbivory; Supporting ecosystem services; Pastoralist governance; Livestock mobility.

Global environmental assessments tend to identify grazing livestock as a degrading factor. Reductionist views argue for meat reduction in sustainable diets, while promoting land use changes that favor afforestation, thus further promoting the mitigation of greenhouse gas emissions. However, this understanding is based on interpreting many of the Earth's ecosystems today as potential closed-canopy forests, held only in an open state by artificially high herbivory levels. We argue that natural levels of herbivory have to be re-examined due to their importance for long term ecosystem function. Our understanding of baselines and consequent distribution and management of land-uses may change accordingly, warranting the consideration of livestock as a tool to maintain important ecosystem services. Theoretical and empirical work on plant ecology has shown that the disturbances brought by herbivory are fundamental to maintain biodiversity and ecosystem functionality in plant communities worldwide. Disturbance is important to relax competition, particularly for light, thus allowing for the coexistence of a wider range of species. The abundance of plant species needing a high degree of exposure to light also confirms the naturality of high herbivory levels. Herbivores, as well as fire, are shown to play a decisive role in nutrient cycling in the last millions of years. However, the existing ecological interpretations still provide non-nuanced views on herbivory, linking functionality of herbivory only with high plant productivity levels, and considering it destructive in drylands. Here we discuss the shortcomings of conventional approaches to herbivory. In this perspective, we reflect upon the role of pastoralism in maintaining important ecosystem functions, analogous to those initiated and maintained by the long extinct megafauna. We do so by combining paleontological evidence from important phase transitions and faunal reorganizations, the appreciation of often dismissed functions played by megaherbivores, and detailed understanding of key processes in sustainable pastoralist practices, with herd mobility and pastoralist governance being central. Sustainable livestock practices are tightly related to the high levels of herbivory that mobility allows, as they provide wide variety of ecosystem services. This includes supporting ones, such as habitat maintenance, soil formation, and nutrient cycling, but also regulating ones, such as erosion control, maintenance of pollinators, or sustaining production systems with a low C footprint, and provisioning ones – such mobile systems outperforming sedentary ones in the amount of human food produced. We contend that pastoralist systems are complex, sustained by a rich traditional knowledge that needs to be conserved in a post-fossil world, where cheap energy may no longer be available and low-input production may have to be recovered.

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O39

A vade-mecum for grazing and health

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Keywords

Phytochemicals; Grazing ruminants; Human health; Healthscapes.