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Review Article

# Production and Environmental Implications of Equine Grazing

Rebecca C. Bott PhD [a,*], Elizabeth A. Greene PhD [b], Katherine Koch MS [a], Krishona L. Martinson PhD [c], Paul D. Siciliano PhD [d], Carey Williams PhD [e], Nathalie L. Trottier PhD [f], Amy Burk PhD [g], Ann Swinker PhD [h]

[a] Department of Animal Science, South Dakota State University, Brookings, South Dakota
[b] Department of Animal Science, University of Vermont, Burlington, Vermont
[c] Department of Animal Science, University of Minnesota, St. Paul, Minnesota
[d] Department of Animal Science, North Carolina State University, Raleigh, North Carolina
[e] Department of Animal Sciences, Rutgers, The State University of New Jersey, New Brunswick, New Jersey
[f] Department of Animal Science, Michigan State University, East Lansing, Michigan
[g] Department of Animal and Avian Sciences, University of Maryland, College Park, Maryland
[h] Department of Animal Science, Pennsylvania State University, University Park, Pennsylvania

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ABSTRACT

Horses' physical and digestive well-being is often enhanced when allowed to graze on pastures. Furthermore, a well-managed pasture can contribute to economic viability. Grazing can however have deleterious effects on the environment if not properly managed. Although equine grazing, defecating, and ground trampling behavior is unique from that of other livestock species, pasture management practices are often based on those derived from cattle grazing. This review summarizes the current knowledge of impacts of equine grazing on pasture quality and environment and identifies gaps where further information is needed to formulate and recommend sustainable grazing methods specific to equine.

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## 1. Introduction

Horses assume a unique role in developing an ecological niche through their grazing behavior. They fertilize via urination and defecation and can modify soil structure by trampling during periods of exercise and turnout. Pasture is a good source of nutrition for the estimated 9.2 million equines in the United States, with over 90% of U.S. equine operations allowing resident horses access to pasture during the day [1,2]. Grazing offers a myriad of benefits, however, poor manure and grazing management practices increase movement of sediment, nutrients, and pathogens into nearby surface waters causing a decrease in water quality [3]. It is important to acknowledge that these negative implications can occur when any animal is left on an area of land for too long. Horses are large bodied selective grazers; their very existence on pastures increases soil compaction, grazing intensity of forages, and manure deposition on pastures at an average rate of 18-22 kg each day. Although horse farm operators do not typically view themselves as stewards of the land, but rather as animal caretakers, almost half of horse farm operators surveyed in the northeast United States believe horse farms had a strong potential to impact the environment [4,5]. In fact, horse farm operators in many parts of the United States are facing serious regulatory issues regarding horses housed on pasture [6]. It is therefore increasingly critical to educate horse farm operators on the best management practices (BMP) that foster management of the environment as well as health and welfare of their horses in order to bring them into compliance with regulatory agencies.

* Corresponding author at: Rebecca C. Bott, PhD, South Dakota State University, Box 2170, Brookings, SD 57071.
*E-mail address:* rebecca.bott@sdstate.edu (R.C. Bott).

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Although great advances have been made in the fields of equine nutrition, physiological, and veterinary sciences, very little scientifically based information is available regarding the environmental impacts of grazing horses on pasture. This review presents the benefits of pasture access and grazing on horse health, pasture quality and sustainability, summarizes the available information related to the environmental impact of horses grazing on pasture, and identifies knowledge gaps in the scientific literature.

## 2. Nutrition and Health Benefits of Pasture to the Grazing Horse

Depending on the geographical region, well-managed pastures may provide year-round ground cover and an economical feed source that can meet all of a horse's daily nutrient requirements. The digestible energy and crude protein provided by pasture can potentially meet the requirements of horses across several physiological states (e.g., maintenance, light work). Furthermore, well-managed pastures may also support mares during gestation and lactation [7]. The total acreage required per animal will depend on the physiological status of the horse and forage quality and quantity. Horses, depending on their physiological status, require 1.67-3.0 Mcal/kg dry matter (DM) and 6.3%-13.9% crude protein on a daily dietary concentration basis [8]. The lower values of these ranges correspond to mature idle horses with maintenance-only requirements, while the upper values correspond to a 5-month-old weanling. Pastures composed mainly of grass (both cool and warm seasons) with some legume, analyzed between 2001 and 2011, contained between 2.16 and 3.0 Mcal digestible energy (DE)/kg DM [9]. Crude protein concentrations for both cool and warm season grass pasture ranged from 7% to 23%, averaging 19% [10].

The delivery of minerals and vitamins through pasture-based diets is highly variable. The concentrations of Ca and P reported for 9,432 pastures ranged from 0.27% to 0.82% and 0% to 0.78%, respectively [10]. The range of Ca and P requirements for horses is 0.2% and 0.14% (maintenance) to 0.8% and 0.45% (5-month old weanling), respectively [8]. Selenium content is highly variable depending on soil concentrations, which are highly dependent on the region. Pasture also generally lacks adequate Na, Cl, Cu, and Zn, which is why offering salt and trace mineral supplements to horses on pasture is recommended. On the other hand, pasture is an excellent source of fat soluble vitamins, with values of 195 $\pm$ 59 IU/kg DM and 34 $\pm$ 25 mg/kg DM reported for vitamins E and A equivalents (beta carotene), respectively. (P. Siciliano, personal communication).

Pasture forage also has a desirable profile of poly-unsaturated fatty acids for horses. According to a recent review [11], the content of omega-3 fatty acids, such as $\alpha$-linolenic acid, represents a high fraction of the fats found in forages, thereby contributing to meeting the omega-3 fatty acid requirements of horses. Fresh forage fatty acid concentrations, depending on the plant's stage of growth, can be increased by fertilization with nitrogen [12] and will decrease as plants mature. Nonetheless, fresh pasture has higher concentrations of fatty acids than forages that have been ensiled or preserved as hay.

Horses allowed access to pasture have fewer stereotypical behaviors such as cribbing and wind sucking [13] than horses confined in stalls. Confined horses are usually meal fed with brief periods of forage access, which may increase the occurrence of chronic obstructive pulmonary disease [14]. Horses with decreased exposure to pasture also have a higher risk factor for colic [15] and gastric ulceration [16]. Pastured horses are able to participate in voluntary exercise, which is essential for bone development in young colts [17], and horses with chronic obstructive pulmonary disease thrive when grazed at pasture rather than fed hay in confinement [18].

## 3. Benefits of Pasture to the Horse Farm Operator and Environment

The benefits of well-managed pasture are extensive, contributing to the well being of the horse and the land. First, a productive and properly managed pasture can meet most if not all of the horse's nutritional requirements during the grazing season, thus limiting the need to purchase additional forage or grains. Thus, supplemental hay feeding would be limited to only summer drought periods and times when access to forage is limited (winter). Furthermore, when horses spend more time on paddocks, manure deposits are a source of nitrogen, potassium, and phosphorus for pasture plants, potentially decreasing fertilizer application time and cost, and also reducing labor and bedding costs.

Properly managed pasture typically has greater than 70% vegetative cover. Vegetative cover maintains water quality by reducing soil erosion and nutrient runoff [19,20]. Pasture may also decrease greenhouse gas emission via $CO_2$ sequestration compared to tilled cropland [21,22]. Reduction in utilization of fossil fuels, reduced requirements for inorganic fertilizer application, and improvement in air quality have been vaguely attributed to proper management of pastures. There are no data available in the literature however to support these claims for equine operations. Therefore, there is a need to develop "equine-centered" practices that farm managers can implement to quantitatively and accurately evaluate pastures.

## 4. Potential Environmental Impacts of Grazing Horses

### 4.1. Vegetative Damage

The act of grazing by animals, including horses, can cause irreparable damage to plant structures, and is influenced by grazing time in a restricted area, along with other factors including plant type, climate, and soil fertility. The effects of horses on pastures can be quite stunning if pastures or paddocks are overexposed to horses compared to areas where access has been limited (Fig. 1). Horses are selective grazers, consequently, they overgraze certain areas and ignore others, such as those areas where manure is present or vegetation is deemed unpalatable [23]. This selectivity results in areas where desirable vegetation is grazed below the point of recovery and regrowth, while ungrazed vegetation continues to grow and mature. Hence monitoring canopy cover is critical to ensure pasture