A key challenge in cattle production on rangelands is matching natural changes in the seasonal availability of forage production, with ongoing grazing activities throughout the growing season. Ideally, changes in seasonal plant growth and associated forage supply will provide a steady supply of nutrients that coincides with all phases of the beef production cycle, including spring green-up, early to mid-summer peak lactation, and when cattle begin putting on energy reserves in late summer in preparation for winter. In the northern regions of the Great Plains, much attention has been dedicated to minimizing the cost of livestock grazing due to the relatively short growing season.¹

Within the mixed grass prairie, forage supply is known to be variable in both space²³ and time.⁴⁵ Variability in space is regulated by changes in ecologic site conditions, including factors that alter resource availability (water and nutrients) combined with associated changes in plant species composition. Among the critical soil characteristics altering grassland productivity is texture,⁶ which has a marked impact on a number of soil properties regulating plant growth, including water infiltration rates, moisture holding capacity, nutrient exchange, and plant rooting opportunities. Although sandy soils tend to have lower water and nutrient availability compared with finer-textured soils, sandy soils enable deeper root penetration,⁷ which can facilitate water use from the subsoil, including moisture that may have accumulated over the dormant season. In addition, sandy soils have the benefit of facilitating rapid water entry into the ground, allowing moisture to escape evaporation from the ground surface, a process that is particularly important when rainfall events are small. This can lead to greater production in sandy soils compared with adjacent loam soils,⁸⁹ a phenomenon known as the “inverse texture effect.”¹⁰ Variations in ecologic site conditions ultimately lead to many different plant community types in the northern mixed grass prairie,⁸¹¹ each of which has its own expected level of productivity and corresponding grazing opportunities.¹²

Temporal variability in herbage production is caused by changes in growing conditions, which, in the case of the northern mixed grass, is mostly precipitation.⁴⁵ Moisture deficits in particular constrain plant production and grazing opportunities in the mixed grass region of western Canada.¹³ Although the majority of precipitation occurs during the summer and therefore coincides with peak water demand from plant growth,¹³ dormant season precipitation also contributes positively to production.⁷ Moisture falling during the dormant season enters the soil and contributes to water recharge, which is then available to support plant growth the following summer.