Drought and extreme temperatures have long challenged ranchers in North America faced with the daunting task of earning a living from complex prairie landscapes. Ongoing increases in average temperatures, combined with heightened variability in precipitation, greatly complicates the ability of livestock producers to maintain the stable forage supplies necessary to support existing cattle herds and ensure long-term profitability. While modeled projections of climate change associated with rising greenhouse gases vary somewhat, they all generally point towards marked increases in growing season temperatures, accompanied by decreased, and in some cases, increased, summer rainfall. These climatic alterations, in turn, will likely impact the quantity and quality of forage supplies in our prairies, changes that may be further augmented by the effects of ongoing grazing itself. For example, two common side effects of heavy grazing are a reduction in the amount of insulating surface litter necessary for moisture conservation and a reduction in rooting depth of key forage plants, both of which may reduce forage production and further increase the susceptibility of prairie vegetation to periodic drought.

In an effort to understand the effects of climate change on grazing resources, researchers at the University of Alberta recently carried out an experiment simulating changes in climate within three native grasslands across western Canada, one in each of the prairie provinces (Alberta, Saskatchewan, and Manitoba). To increase air temperatures, they set up small fiberglass greenhouses, termed open-top chambers, which increased daytime temperatures during the growing season in the 4 m² experimental plots by 1–3 °C. They used rain-out shelters to decrease precipitation by 60%. Climatic treatments also had ambient controls and were further tested under three contrasting clipping regimes: heavy, light, and no summer clipping. All treatments were applied factorially so that any interactions among them could be examined. To evaluate potential impacts on the cattle industry, the researchers measured changes in grass, forb, and total herbage production over a three-year period, together with alterations to forage quality, as represented by changes in protein concentration.

The results of the study were published in the January–February 2014 issue of Agronomy Journal. Although many of the results were contingent on location, year, or specific combinations of treatments, several important trends were evident in the data. Overall, the researchers found that reduced precipitation (−25%) and clipping intensity (−13%, low intensity; −32%, high intensity) had the greatest negative impact on season-long accumulated forage. Similarly, warming (−8%) reduced forage availability. Marked variation was also found in the susceptibility of different native grasslands to drought. For example, forage decreases due to reduced precipitation ranged from little response in the arid mixed-grass prairie of southern Saskatchewan to a 20% decline in boreal grasslands of north-central Manitoba and a large reduction of 43% in the aspen parkland of north-central Alberta. Additional climate-related impacts were noted on forage regrowth patterns following early-season clipping, with reduced precipitation sharply reducing grazing opportunities in late summer, as evidenced by a 33% drop in regrowth biomass. Finally, warming and reduced precipitation led to absolute declines in protein concentration of 0.4% and 1% respectively, which were attributed to early senescence associated with the premature onset of water stress during the growing season. Losses in graminoid biomass and quality with climate were more pronounced than corresponding losses in forbs.

Results of this research, particularly those on the widespread sensitivity of grasslands to warming as well as the locational dependence of grasslands to drought, have important implications for livestock producers. This in turn, raises significant concerns over the ability of native grasslands under ongoing increases in global temperatures to continue to provide the forage resources needed by the cattle industry. Under warming, an 8% decline in forage availability would translate into a substantial reduction in the national cattle herd or risk overgrazing existing grass-