UNIVERSITY OF ALBERTA

Rangeland Research Institute

Virtual Fencing for Real-Time Flexible Control of Grazing Beef Cattle

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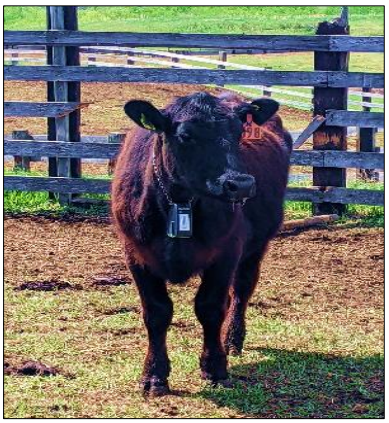
Beef cattle production on pasture is heavily dependent on strategies to control where, when and how often animals graze a given area. Along with mineral and salt placement, and control over the availability of water, a common method to manipulate animal use in Canada is physical fencing, including both permanent and temporary (electric) fencing. The use of fencing, in turn, facilitates the implementation of complex grazing systems, including adaptive, multi-paddock (AMP) rotational grazing, in which cattle are moved from one small pasture to another, often at frequent intervals (e.g,, every day or two).

Given the widespread nature and high cost of fencing, strategies to reduce fencing costs have the potential to greatly decrease the cost of beef production, as well as improve the adaptive nature of managing grazing patterns in space and time. Virtual fencing (VF) is an emergent technology intended to control livestock grazing in real-time, while reducing the overall cost of constructing and maintaining physical fencing intended to contain animals. VF technologies are analogous to 'dog shock' containment areas, but applied to domesticated livestock such as cattle while grazing. Once fitted with the collar, global positioning system information is used to continuously track the location of animals in real time, and software is used to create a 'virtual fence' containment area. Animals approaching the boundary receive multiple audio warning signals before ultimately being subject to an electric stimulus, where the latter elicits a response in the animal to move away from the boundary. Following a training period in which cattle learn to expect an electric stimulus after an auditory warning, cattle can be constrained within the VF fence boundary.



Left: a herd of heifers fitted with NoFence™ collars at the Kinsella Research Ranch, allowing for control of their movement in space and time. Right: a cow just after being fitted with a collar.

Because the boundary is programable, it can be readily moved in space and time using a cellular network, thereby allowing for a highly flexible and remote tool to alter grazing behavior and patterns of pasture use.

The University of Alberta has initiated research testing the application of NoFence™ VF technology to manipulate patterns of cattle grazing in real-time. Initiated in June of 2022, this study is examining the behavior of 49 heifers and 2 bulls, first while being trained following the introduction of VF technology, and second during the implementation of a simple rotational grazing system. Data are being collected on the type (auditory vs electrical) and frequency of stimuli received, escapes, and how changes in grazing pressure (ongoing forage depletion while in a given pasture) alter these responses.

Results of this work are expected to provide a comprehensive test of VF technologies in Canada for the confinement and management of beef cattle, and help chart a pathway to increase the availability and use of VF platforms for contemporary cattle management. Increased use of VF will reduce the cost of infrastructure (fencing) costs for the beef industry, while simultaneously maintaining and even increasing the flexibility of producers in applying contemporary rotational grazing systems (such as AMP) in real-time within grazed environments.

Left: Map of cattle geolocations during a 24 hour period shown as a heatmap, including the last known position of cattle represented by each collar icon. Cattle are contained to the east half of the physical pasture, whereas the west side of the blue polygon is outside the virtual fence boundary. Cattle are also accessing a water source situated within a nearby pasture (bottom) using a virtual fence to isolate the water source within the adjacent pasture. Two isolated observations on the west side of the blue polygon represent 'escapes'.

This study is supported by the Smart Agriculture and Food Digitalization and Automation Program of Alberta Innovates, Results Driven Agricultural Research (RDAR), the Canadian Agricultural Partnership (CAP), and the Alberta Beef Producers.

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